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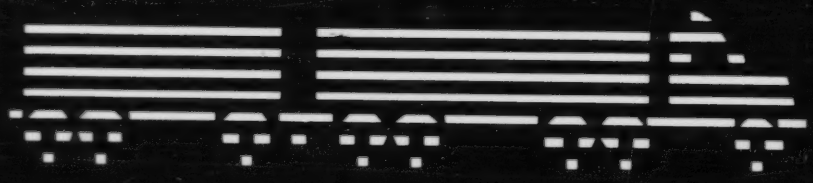

STUDY OF VEHICLE WEIGHT AND DIMENSION REGULATIONS AND CANADA'S TRUCKING INDUSTRY

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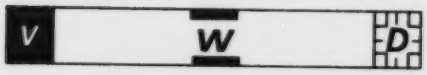

VEHICLE WEIGHT & DIMENSION REGULATIONS AND CANADA'S TRUCKING INDUSTRY

THE REGULATIONS

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17. Abstract

A comparative analysis of the regulations controlling the size and the weight of trucks in each Canadian province and territory is presented. The review of current vehicle weight and dimension regulations treats such elements as allowable heights, widths and lengths, tire loads and axle loads, and is supplemented by accounts of relevant historical changes to the regulations. Special topics such as seasonal regulations, road classes, tolerances and special permits are also concerned.

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17 Résumé

Ce rapport présente une analyse comparative des réglementations en vigueur dans les dix provinces et les deux territoires du Canada en ce qui concerne les poids et dimensions des véhicules de transport routier. Cette analyse porte notamment sur les points suivants: hauteurs, largeurs et longueurs autorisées, charges par essieu et par roue, de même qu'elle rappelle les modifications successives apportées auxdites rubriques des règlements. Elle aborde également des sujets particuliers comme les règlements saisonniers, les classes de routes, les tolérances et les permis spéciaux.

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Foreword

This research originated at the time of the announcement of the Roads and Transportation Association of Canada / Canadian Council of Motor Transport Administrators (RTAC/CCMTA) study into heavy vehicle weight and dimension regulations. At the time, it was felt that there was not enough understanding about the complexity of the relationship between the regulations and trucking.

Since the relationship between weight and dimension regulations and trucking is only part of the information required to formulate optimal regulations, this study cannot by itself lead to any specific recommendations regarding policy (larger trucks? uniform regulations? the axle-spread regulations in one province versus those in another?). Rather, the perspective adopted here has been: this, for better or worse, is the regulatory environment; this is its impact on trucking; hopefully this relationship will be considered when the "technical" factors developed from the RTAC/CCMTA study are incorporated into new regulations.

The focus of the research has been to put together an understanding of how the twelve sets of weight and dimension regulations in Canada work, where the major differences are, and what the implications for truck operators are. This report describes and analyzes the regulations as of the winter of 1986/87. The material in the final report, *Vehicle Weight & Dimension Regulations and Canada's Trucking Industry: Final Report*, describes the impact of these regulations in terms of how the different regulations affect the design of truck combinations, how the trucks that result affect trucking costs and rates, how the different regulations have affected the characteristics of truck fleets in various parts of the country, and how individual operators make decisions in terms of their own operations. A separate report, *Vehicle Weight & Dimension Regulations and Canada's Trucking Industry: Case Histories*, describing some of the vehicles configurations in Canada has also been published.

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1. Introduction

1.1 OBJECTIVES

The object in this report is to describe, compare, and analyze weight and dimension regulations in Canada. These regulations control the size and weight of trucks in each of the provinces and territories.

1.2 SCOPE

The scope is as follows:

- GEOGRAPHICAL/JURISDICTIONAL: The prime focus is on the regulations in the 12 provinces ("provinces and territories"). However, some attention is also given to the regulations in the 14 bordering U.S. states and the role of local governments.

- TIMEFRAME: "Current" regulations are as of the winter of 1986/87. Because the impact of these regulations cannot be understood without some understanding of the changes which have occurred since (about) 1970, brief notes documenting these changes are included.

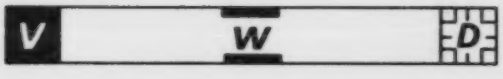
- VEHICLES: Although weight and dimension regulations govern all vehicles using the road, the interest here is only in trucks, and in particular large combination trucks. So, for example, the many exceptions made in the regulations or in some cases the special regulations for farm vehicles which occasionally use public roads are ignored.

1.3 METHODOLOGY

Two sources of information have been used. First, all provincial legislation, regulations, and policy papers have been reviewed. For the comparative U.S. information, a summary chart by the American Trucking Association was used. [1] Second, interviews have been conducted with officials in all provinces in order to clarify interpretations. In some cases, there are differences between these two sources. To ensure accuracy, all provinces were sent drafts of this report; most of them reviewed the material and suggested a variety of changes. This does not mean that they all completely agree with the contents as there are some areas where interpretational differences persist. None of these areas of differences in interpretation is particularly important.

The most difficult part of the work has been to develop a format to present this description. The format of the regulations in one province can be quite different than the format in another. The process of developing this format is described in Part 2. For here, the important point to note is that the information presented in

this report has been "normalized" to permit a comparative analysis. This has required the use of standard terminology and the classification of information in a manner not necessarily compatible with any individual jurisdiction's weight and dimension regulations.



2. Outline

2.1 INTRODUCTION

Roads and most regulations pertaining to roads fall under provincial jurisdiction. As a result, there are 12 different sets of weight and dimension regulations. These are different not only in what is allowed or prohibited, but also in the manner in which they are written. In fact, the differences in format are great enough to make comparisons difficult.

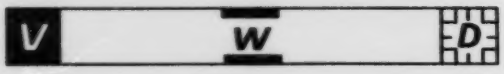
A number of procedures have been used to compare regulations in one province with those in another. In Part 3, regulations are considered to deal with a number of "elements" in a sequential order, and, within each of these elements, a number of topics are considered also in a sequential order. This mechanical ordering of the subject makes it possible to consider the regulations in a logical fashion; none of them are written this way. In Part 4, some special topics are considered: some of these are additional to the elements considered in Part 3; some summarize the scattered conditions that affect the application of elements. To aid the understanding of interjurisdictional differences, Part 5 consists of a number of analyses and/or comparisons. To ensure clarity, various terms have been defined in a standard manner (even though the definitions in the regulations vary considerably). This outline of elements, topics, special topics, and analyses/comparisons is explained in the next four sections. The definitions are contained in a Glossary in the companion report (Vehicle Weight & Dimension Regulations and Canada's Trucking Industry: Final Report); some of the more important are discussed below.

2.2 ELEMENTS OF WEIGHT & DIMENSION REGULATIONS

The regulations govern the following 13 elements of a truck:

- vehicle height
- vehicle width
- vehicle length - trucks & tractors
- vehicle length - trailers
- vehicle length - semitrailers
- vehicle length - combinations
- tire loads
- axle loads - single-front-steering
- axle loads - other-front-steering
- axle loads - single
- axle loads - tandem
- axle loads - triple
- gross vehicle weights

In many cases, the regulations consider a number of these elements together (eg, regulations on allowable front-axle loads which combine tire-load regulations); or, what amounts to almost the same thing, other regulations impose conditions on



one of the above elements in terms of some other element (eg, gross vehicle weights allowed given a certain front-axle load).

2.3 TOPICS CONSIDERED

In the discussion of each element, the following topics are considered (dropping some topics, for some elements, where warranted):

- CURRENT REGULATIONS: The regulations considered are the "standard current regulations". This phrase has no meaning in any of the provinces; it is used here to describe those regulations governing most trucks operating in summertime conditions (ie, no frozen or thawing roadbeds), on the highest road class, within the limits of the general (ie, not special permit) regulations.

- CONDITIONS: Conditions are those factors pertaining to the application of the standard current regulations.

- EXCEPTIONS: It is cumbersome to follow the precise wording of all the provincial "exceptions" (at least if comparisons are to be made). There are a number of exceptions that are not dealt with here: all of these apply to such things as farm equipment, road-maintenance equipment, snow ploughs, etc. The exceptions that are dealt with apply to trucks used for commercial freight transportation purposes. Note, though, that "exceptions" do not include trucks operating under special permits.

- SEASONAL CONSIDERATIONS: Some aspects of the regulations change for "spring" or "winter" conditions (a variety of terms are used in the regulations).

- ROAD CLASS CONSIDERATIONS: Some elements of the regulations change for different classes of roads. In practice, some regulations change when seasonal and road class and sometimes other conditions change.

- CHANGES SINCE 1970: Brief comments are included where possible on the changes that have occurred since (approximately) 1970.

- REGULATIONS IN BORDERING STATES: A summary of the regulations in the 14 bordering states is provided. The regulations shown are comparable to the "standard" regulations for Canadian jurisdictions; no attempt is made to provide the amount of detail necessary to understand the full scope of American regulations.

- TECHNICAL BASIS FOR THE REGULATIONS: Where useful, from the perspective of understanding the regulations or differences between jurisdictions, a comment is made on the technical basis for weight and dimension regulations.

- POLICY/ENFORCEMENT PRACTICES: Notes are included where it has been determined that some aspect of policy (in comparison to written regula-

tions) or where some enforcement practices are important in the understanding of the weight and dimension regulations.

- COMMENTS: By way of summarizing the discussion of each element, observations are provided about the nature of and basis for inter-jurisdictional differences.

2.4 SPECIAL TOPICS

After describing the 13 elements of the regulations, two topics are summarized and three new ones are introduced in Part 4. The summaries are for the seasonal and road-class aspects of the regulations; they have been included for the convenience of drawing together the various comments in Part 3. The new topics introduced are tolerances (Section 4.3), the role of local governments (Section 4.4), and special permits (Section 4.5).

2.5 ANALYSIS 7 COMPARISON

The discussion of the regulatory elements in Part 3 provides all of the material necessary to understand the regulations in each jurisdiction and the differences between jurisdictions. Nevertheless, the subject matter is so complex that some aspects of these regulations are not apparent until they are analyzed further. This is particularly true where more than one element is involved in determining allowable vehicle types (eg, considering allowable single-axle loads given tire-load regulations and the spacing between axle groups). In Part 5, a number of these analyses and/or comparisons are presented.

2.6 DEFINITIONS

It is impossible to develop a description of the 12 sets of weight and dimension regulations without agreeing on some of the more common terms. In fact, even prior to the discussion of regulations in Part 3, the first major interjurisdictional difference to note is that there are some significant differences in the definitions used in one province in comparison to other provinces; in other cases, there are minor or subtle differences in definitions that add to the heterogeneity in Canadian weight and dimension regulations.

An attempt has been made here to use commonly understood functional definitions. Since the original version of this report (October 1985), the RTAC/CCMTA study -- the CTRC report* -- has appeared with its own list of definitions. [2] To the extent possible, usage in this report has followed these CTRC definitions. In the following, some of the important aspects about these definitions are discussed and areas where terms used here differ from those used in the CTRC report are noted.

---

* *Canroad Transportation Research Corporation.*

2.6.1 Vehicles

There are four basic vehicles: trucks, tractors, trailers, and semitrailers -- all defined in the Glossary. A dolly, an "A-dolly converter" or a "B-dolly converter," is used to convert a semitrailer into a full trailer.In this report, the term "truck" is often used in a general sense to mean any combination of these vehicles (if there is any possibility of confusion, the term "straight truck" is introduced).

The definitions in the Glossary are not perfect. For example, given the growing incidence of tractors with some form of load-carrying device (a drome, a platform for a container, platforms or head-ramps for automobiles), it is becoming difficult to define the difference between a tractor and a straight truck. Functionally, the distinction between the two may be no longer particularly useful. However, from a regulatory perspective the distinction between a tractor and a truck is sometimes important as some provinces apply different regulations to vehicle combinations that include trucks versus those that include tractors.

The four vehicle types (truck, tractor, trailer, semitrailer) are generally used in the following combinations:

- truck + trailer
- tractor + semitrailer
- tractor + semitrailer + single-drawbar trailer (A-train)
- tractor + semitrailer + semitrailer (B-train)

Other standard (ie, not specially-permitted) vehicle combinations which are less common include:

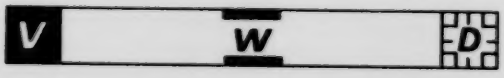
- truck + stiff-poled-pup trailer
- tractor + semitrailer + stiff-poled-pup trailer
- tractor + semitrailer + double-drawbar trailer (C-train)

There are a variety of other combinations that are only permitted in some provinces on the basis of special permits. These include the Rocky-Mountain double, the Turnpike double, and the triple which has a total of three semitrailers and/or full trailers.

The terms "double" and "train" are commonly used in several different ways. For here, a double is a truck-plus-trailer or a train. A "train" is a tractor plus two (or more) semitrailers and/or trailers.

2.6.2 Dimensions

"Vehicle height" means the distance from the road surface to the highest point on a vehicle or its load, whichever is higher; "vehicle width" means the width of a vehicle or its load, whichever is wider; and, "vehicle length" means the longest longitudinal dimension of a vehicle or its load. However, in the specific case of trailers, "length" excludes the drawbar. "Combination length" means the longest longitudinal dimension of a vehicle combination or its load.



2.6.3 Axles

Axles and various arrangements of axles are defined in a number of ways in different regulations. Some of these differences are explored in subsequent sections. The general terminology used here is "single axle," "tandem axle," "triple axle." These three basic types may be combined into "axle groups," "tri-axles," or even "quad-axles."

The important point, given the usage in this report and the differences among the regulations, is that tandem and triple axles are used to mean axle groups which have a means of approximately equalizing loads, and, in the case of the triple axle, equal inner spreads. Three axles on a semitrailer that do not have equal spreads and that do not equalize loads are referred to as a "tri-axle" in this report, even though this differs from common usage in some parts of the country and from the CTRC usage where tri-axles are defined to be triple axles. A common tri-axle consists of a tandem axle plus an air-lift single axle. The term "quad-axle," although rarely used, means four axles on a semi- trailer with unequal spreads and unequal loads.

Single, tandem, and triple axles may be further classified as steering, drive, fixed, air-lift and self-steering. Other terms used to describe axles include "axle group," "axle spread," and "axle spacing." From a regulatory perspective, the definition of these terms is important, and possibly for this reason the usage in this report differs from the CTRC definition. In particular, axle group refers to two or more consecutive axles connected to a single vehicle or to more than one vehicle in a vehicle combination. If the axle group is a tandem or a triple then the term "spread" is used to indicate the distance between the axles; if the axle group consists of more than tandems or triples, then the term "spacing" is used to indicate distances between some of the axles. Although this sounds confusing (and although it differs from CTRC definitions and the definitions in some provinces such as Ontario), there is no other choice given the task of describing the current regulatory maze in Canada.

2.6.4 Road Class

Every province or territory has its own method and terminology for classifying roads. In this report, the terms "primary highway," "secondary highway," and "other highway" are used in a general sense (see the Glossary). These terms do not coincide with the particular usage in particular provinces and/or territories.

3. The Elements of Weight & Dimension Regulations

3.1 ALLOWABLE HEIGHTS

- CURRENT REGULATIONS: Regulations governing the height of vehicles and loads are shown in Table 1.

*	current regulations 4.5 m - PEI 4.2 m - Yukon, NWT 4.15 m - 8 provinces 4.12 m - NB
*	changes since 1970 no change, except for metric conversion
*	regulations in bordering states most allow 13'6" (4.11 m) Idaho & Washington allow 14' (4.27 m) Maine allows loads to 14' (4.27 m)

Table 1 Allowable Vehicle Heights

- CHANGES SINCE 1970: With the minor exception of the conversion to metric, there have been no important changes in these regulations.

- REGULATIONS IN BORDERING STATES: There are no important differences between height regulations in Canada and bordering states, even though there are a few instances of where slightly higher vehicles or loads are allowed.

- TECHNICAL BASIS: The current regulations are based on an ASSHTO recommendation from the 1950s for a standard 13'6" (4.11 m).

- COMMENT: With the exception of Prince Edward Island, there is a high degree of uniformity in height regulations. The difference of 8 cm between 4.12 and 4.2 metres is not significant; the origin of these differences is the method of rounding used in metric conversion.

3.2 ALLOWABLE WIDTHS

- CURRENT REGULATIONS: Regulations governing allowable widths are shown in Table 2. Generally the limit governs the load as well as the vehicle, but excludes such things as mirrors and load-securing devices.

- EXCEPTIONS: Some provinces allow wider limits for vehicles or loads where certain commodities are involved (others may do this through special permits). Ontario allows 2.7 metres for loads of raw forest products when loaded and 2.8 metres in transit; Prince Edward Island, Ontario, Manitoba, and British Columbia all allow wider loads (or have no limits) for loose fodder.

* current regulations
  - 3.05 m - NWT
  - 2.6 m - 11 provinces/territories

* exceptions
  - PEI, Ont, Man, BC - some commodity hauling situations
  - Sask - house trailer (during daylight hours)

* changes since 1970
  - no change, except for metric conversion

* regulations in bordering states
  - 102" (2.59 m) allowed on interstate system (excludes Alaska)
  - 9 bordering states also allow 102" off the interstate
  - 5 allow 96" (2.44) off the interstate

Table 2 Allowable Vehicle Widths

- CHANGES SINCE 1970: Other than metric conversion, there have been no changes. Until recently, most running gear has been built to a standard 96 inches (2.44 m), while boxes and platforms have been built to the limit of 2.6 metres. [3] The reason for this was the 96-inch limit in the U.S.; when this changed (1982), manufacturers on both sides of the border began to build wider running gear.

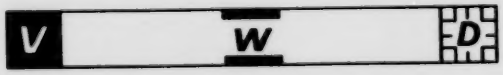
- REGULATIONS IN BORDERING STATES: In Table 2, U.S. regulations are described in terms of the "interstate system" of highways. This is an oversimplification: "interstate system" is used here to mean those highways covered under the Surface Transportation Assistance Act (STAA) of 1982. Under this act, all states were required to permit 102 inches on the interstate system.

- TECHNICAL BASIS: The 102-inch standard (2.59 m) originated with a recommendation from ASSHTO in the 1950s.

- COMMENT: Width regulations are uniform, with the exception of the Northwest Territories.

3.3 ALLOWABLE LENGTHS

Regulations governing allowable lengths are more complex than those governing heights and widths. One of the factors contributing to this is that the prov-



inces classify vehicle types in different ways. Another factor is that in some cases conditions are attached to the regulations (ie, "allowable length is _____, given that _____"). To make sense of these regulations, the following subsections consider length regulations for trucks and tractors, trailers, semitrailers, and vehicle combinations separately even though no province adopts such a format.

3.3.1 Trucks & Tractors

- CURRENT REGULATIONS: In most provinces, there is no specific regulation for trucks or tractors; rather, there is a general regulation governing the length of "vehicles" with certain exceptions such as semi- trailers noted. (Semitrailers or other vehicles are not included as an "exception" here.)

Three points to note are: (i) these length limits apply to loads as well as vehicles in most cases; (ii) allowable lengths (here and in subsequent sections) generally exclude certain equipment (eg, energy- absorbing bumpers); and (iii) there are regulations on overhanging loads (ie, how much is allowed, safety measures) that are not dealt with here.

- CONDITIONS: The only known condition attached to any of the regulations shown in Table 3 is in the case of Quebec: motor vehicles may have a length of 12.5 metres as long as the overhang is 5 metres or less. Where this is not met, Quebec limits the length to 11.0 metres.

- CHANGES SINCE 1970: Six of the provinces have increased allowable truck lengths from 35 feet to the current 12.5 metres. (New Brunswick went from 35 feet to 14 metres and back to 12.5 metres.)

* current regulations
  - 12.5 m - 11 provinces/territories
  - 12.2 m - PEI
* conditions
  - Que - limits overhang to 5.0 m (11.0 m length otherwise)
* changes since 1970
  - most provinces have increased by 0.3 to 1.8 m
  - NB - increased from 35' to 14 m (3-axle trucks) and back to 12.5 m
* regulations in bordering states
  - 35' (10.67 m) - N.H. & N.Y.
  - 40' (12.19 m) - 9 bordering states
  - 45' (13.72 m) - Maine
  - 50' (15.24 m) - N.D.
  - 60' (18.29 m) - VT

Table 3 Allowable Lengths: Trucks & Tractors

- REGULATIONS IN BORDERING STATES: Nine of the 14 have length limits similar to those in Canada.

- COMMENT: There is a high degree of uniformity in the regulations governing the length of trucks and tractors.

3.3.2 Trailers

- CURRENT REGULATIONS: There are three groups of provinces: those in which "trailer" is the same as a "vehicle" in terms of length regulations (Ontario, Manitoba, Saskatchewan, and Alberta); those which have a specific limit for trailers; and those which have no restriction on the length of a trailer.

*	current regulations
	14.65 m - Nfld, NS, NB, Que
	13.5 m - Yukon
	12.5 m - Ont, Man, Sask, Alta, BC, NWT
	no restriction - PEI,
*	changes since 1970
	unclear; "trailers" probably treated as "vehicles"
*	regulations in bordering states
	28' (8.53 m) - VT., Penn
	28.5' (8.69 m) - N.Y., Ohio, Wisc., Minn.,
	48' (14.63 m) - Maine, N.H., Idaho, Wash., Alas.
	50' (15.24 m) - Mich.
	no restriction - N.D., Mont.

Table 4 Allowable Lengths: Trailers

- CHANGES SINCE 1970: The increase in trailer lengths has been similar to those for single-powered vehicles. The 1970 regulations are not fully known; the effective limit on lengths was probably the limit on combination lengths and the regulations governing vehicle combinations.

- REGULATIONS IN BORDERING STATES: There is a great deal of diversity in the U.S.; allowable lengths vary from 28 feet to no limit.

- TECHNICAL BASIS: The technical basis for trailer-length limits is unclear (ie, given combination and other length regulations). It may be that the existing limits have been set more-or-less by default, as part of the truck and tractor or semitrailer-length limits.

- COMMENT: The apparent diversity in regulations (12.5 m to no limit) may not be that significant in practice. As full trailers are only used in combination with other vehicles, the more critical constraint is the allowable

combination lengths. It is difficult to understand the retention of a 12.5 metre limit on trailers when at the same time semitrailers are generally permitted 14.6 metres or more.

3.3.3 Semitrailers

- CURRENT REGULATIONS: The regulations governing the allowable lengths of semitrailers are shown in Table 5: in some provinces there is no regulation -- the lengths governed by allowable combination length limits. The difference between 14.6 and 14.65 metres is inconsequential: the real length is 48 feet (ie, the length trailer manufacturers use). The 13.5 metre limit in the Yukon is equivalent (roughly) to the old 45- foot limit, and will probably be revised in the future.

* current regulations
  - 15.5 m - Que, with conditions
  - 14.65 m - Nfld, NS, NB, Ont, BC
  - 14.6 m - Sask
  - 13.5 m - Yukon
  - no restriction - PEI, Man , Alta, NWT

* conditions
  - Que - limits some internal dimensions (14.65 m otherwise)

* exceptions
  - Ont - exempts semitrailers "designed for the carriage of vehicles" (no limit applies)
  - BC - semitrailers with more than 2 axles in contact with the ground limited to 14.0 m

* changes since 1970
  - general increase of 0.9 m (48' versus 45')

* regulations in bordering states
  - under the STAA, all states must allow 48' (14.63 m) on the interstate system; 4 bordering states allow longer or else have no restriction (Ohio, Mich., N.D., Mont.)

Table 5 Allowable Lengths: Semitrailers

- CONDITIONS: The only known condition attached to these regula- tions is in respect of Quebec where 15.5 metres is allowed as long as the distance between the "pivot point" (kingpin) and the centre of the rear axle is 13.0 metres or less. In a practical sense, this condition creates an articulation characteristic similar to that of a 14.65 metre semitrailer with a standard kingpin offset (a little less than a metre) and a standard overhang (of about a metre).

- EXCEPTIONS: The exception shown for British Columbia, with respect to semitrailers with more than two axles ("on the ground") only applies until April 1, 1988; the intent is to forestall the use of triple axles or tri-axles on the new 48-foot (14.65 m) semitrailers until the completion of the RTAC/CCMTA study.

- Changes since 1970: The general increase since 1970 has been from 45-foot semitrailers (with many shorter ones in use) to 48-foot semitrailers (now coming into widespread use).

- REGULATIONS IN BORDERING STATES: The 48-foot semitrailer has become the standard in the U.S., and is the main reason for the (more recent) adoption of 14.65 metres in Canadian jurisdictions.

- TECHNICAL BASIS: The reason for limiting semitrailer lengths is associated with highway geometry requirements. The turning characteristics of a tractor and semitrailer determine certain geometric design features of a highway, and in particular the radii and lane widths of turning roadways and on/off ramps, and the requirement for adequate space at intersections to facilitate permitted movements. Given other things equal (ie, tractor wheelbase, fifth wheel offset and the positioning of the semitrailer's kingpin and axle(s) relative to the front and rear of the semitrailer respectively), the longer the semitrailer, the greater the geometric requirement.

- COMMENT: There is some diversity in the regulations governing the allowable lengths of semitrailers. As is evident from the preceding discussion, there are inconsistent views held on the technical need for these regulations. Four jurisdictions (five until recently) see no need to limit semitrailer lengths (except incidentally through combination- length limits), and eight see some reason for imposing a variety of different length limits (ranging from 13.5 to 15.5 m).

3.3.4 Combinations

- CURRENT REGULATIONS: Allowable combination lengths are shown in Table 6. There are conditions attached to these regulations in many cases. As these regulations are complex and vary from province to province, Figure 1 and Table 7 contain more detail.

- CONDITIONS: The conditions, in particular the 16.75 metre "kingpin-to-rear" and in fewer cases the 19.0 metre "rear-of-cab-to- rear" requirements, vary considerably and have been changing as this report was being written. These conditions and permitted lengths are defined in terms of four measurements in Figure 1 ("a", "b", "c", "d"), and shown in Table 7.

  - Newfoundland: 20 metres is permitted for two-vehicle combinations; 21 metres is allowed for three-vehicle combinations, where the 16.75 metre kingpin-to-rear limit is met; special permits are required for A-trains.

- Prince Edward Island: Doubles, which require special permits, are allowed to operate at 21 metres.

- Nova Scotia: 21 metres is permitted for all combinations; the only condition is that drawbars cannot exceed 5 metres in length; special permits are required for A-trains.

- New Brunswick: 21 metres is permitted for all combinations; the 16.75 metre kingpin-to-rear limit applies to three-vehicle combinations; special permits are required for A-trains.

- Quebec: 23 metres is permitted for all combinations as long as one of the kingpin-to-rear (16.75 m) or rear-of-cab-to-rear (19 m) limits is met. This wording of the combination length limits coincides with Ontario's (Quebec followed Ontario on these 16.75 and 19 m limits when it increased allowable lengths to 23 m).

- Ontario: 23 metres is permitted for all combinations, as long as one of the kingpin-to-rear (16.75 m) or rear-of-cab-to-rear (19 m) limits is met. Ontario was the first province to write these internal length limits in this manner (the reasons are unknown).

* current regulations
  20.0 m to 24.4 m; see Table 7

* conditions
  see Table 7

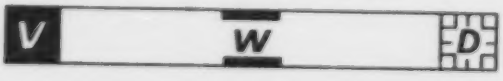
* exceptions
  PEI - 24.4 m for post or pipe hauling
  NS - 25.0 m for post or pipe hauling (non-reducible)
  NB - 24.0 m for pole or pipe hauling (non-reducible)
  Que - 27.5 m for post or pipe hauling
  BC - 21.5 m for 2-vehicle combinations hauling logs (non-reducible)

* changes since 1970
  PEI has decreased
  Que to BC increased by 3.19 m
  other provinces have increased somewhat less

* regulations in bordering states
  no length limits for tractor-semitrailers or doubles on the interstate system (as per STAA, effective June 1983)

Table 6 Allowable Lengths: Combinations

- Manitoba: 21.5 metres is permitted for all combinations except tractor-semitrailers which are limited to 20 metres. Although the



regulations read as if it is only A-trains which are permitted 23 metres, in practice all trains are permitted to operate at this length where the 16.75 metre kingpin limit is met.

- Saskatchewan: 23 metres is permitted where the 16.75 metre king-pin-to-rear limit is met; otherwise allowable length is 21.5 metres except in the case of tractor-semitrailers which are limited to 20 metres. As a matter of practice, the province has ceased to enforce the 16.75 metre limit since 1986.

- Alberta: 23 metres is permitted for A-trains where the 16.75 metre either combinations, except tractor-semitrailers which are limited to 20 metres. As a matter of practice, Alberta allows B-trains to operate at 23 metres if the 16.75 metre limit is met (otherwise 21.5 m). As of the spring of 1987, Alberta is allowing doubles to operate over the 16.75 metre kingpin limit under special permit (pending formal regulatory change). Further, as of February 1987, truck-plus-trailer combinations have been allowed to operate at lengths up to 23.0 metres.

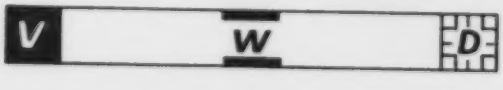
- British Columbia: 20 metres is permitted for all combinations; 23 metres is permitted where there are two or more articulation points; as of the spring of 1987, the province was in the process of changing the 16.75 kingpin limit to an 18.0 metre limit (some combinations are now operating in this manner under special permit); drawbar length cannot exceed 5 metres.

- Yukon: 22 metres is permitted generally; 22.5 is permitted on de-signated highways; special permits are required for trains.

- Northwest Territories: 21.5 metres is permitted for combinations of two vehicles; 24.4 metres is permitted for combinations of three vehicles; no 16.75 metre or 19.0 metre limits.

- EXCEPTIONS: As shown in Table 6, some provinces allow some vehicles to operate at longer lengths than the standard limits. However, provinces other than those shown in Table 6 with exceptions may also allow these types of trucks (eg, carrying poles or pipes) to operate at longer lengths under special permits. Second, the whole subject of the regulations that exist under special permits and, in particular, some of the special vehicle types such as triples or turnpike doubles, are not considered here.

- CHANGES SINCE 1970: Allowable lengths have increased by 3.19 metres (from 65' to 75.5') in most provinces since 1970. The exceptions to this are Atlantic Canada which has not adopted the 23-metre limit. In the case of Prince Edward Island, there has been a reduction in allowable lengths from 24.384 metres to the current 21 metres. The Northwest Territories has adopted a 24.4 metre (80') limit. The increase in length limits has been made necessary to facilitate the use of 7- and 8-axle combinations, the use of which has been increasingly necessary in Western Canada as



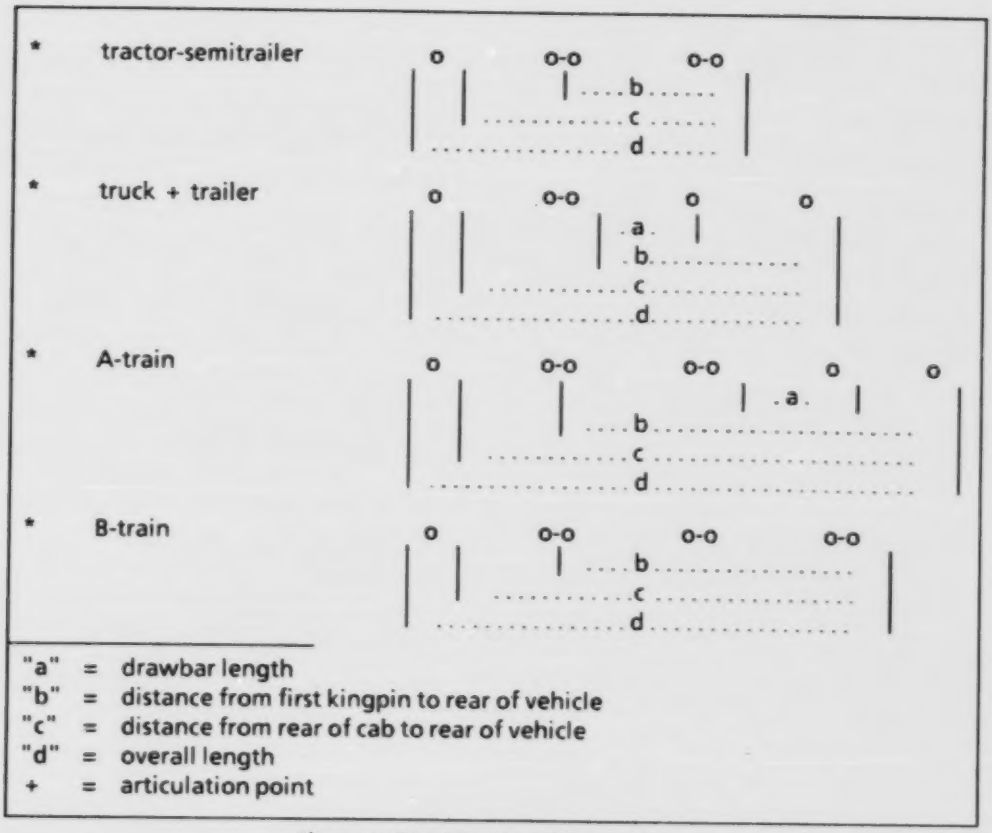


Figure 1 Combination Dimensions

GVW limits have increased (ie, the higher total loads could only be used on more axles which had to be used in double-trailer combinations). Associated with these longer limits has been the introduction of an internal dimensional limitation of 16.75 metres from the (first) kingpin to the rear of the combination. This internal restriction is as important, if not more so, than the overall combination length limit in influencing the detailed characteristics of doubles.

- REGULATIONS IN BORDERING STATES: As required under the STAA, all states must permit tractor-semitrailer combinations to operate on the interstate system with (at a minimum) 48-foot semitrailers and 28-foot doubles. Unlike the Canadian regulations, the U.S. regulations only limit (semi)trailer lengths -- not overall lengths.

- TECHNICAL BASIS: The technical basis for limiting combination lengths is made up of a variety of considerations, including:

  - **Geometric:** the effect of vehicle length on passing sight distance requirements; and the effect of articulation properties on the geometry required to facilitate vehicle turning.

province	tractor semitrailer	truck + trailer	A-train	B-train
Nfld	20.0	20.0	special permit	21.0 'b' ≤ 16.75
PEI	20.0	21.0 m under special permit 'a' ≤ 3.66 m		
NS	21.0 'a' ≤ 5.0 (where applicable)	21.0	special permit	21.0
NB	21.0	21.0	special permit	21.0 'b' ≤ 16.75
Que	23.0 'b' may exceed 16.75 only where 'c' ≤ 19.0 'c' may exceed 19.0 only where 'b' ≤ 16.75	23.0	23.0	23.0
Ont	23.0 'b' may exceed 16.75 only where 'c' ≤ 19.0 'c' may exceed 19.0 only where 'b' ≤ 16.75	23.0	23.0	23.0
Man	20.0	21.5	23.0 'b' ≤ 16.75 (otherwise 'd' = 21.5)	23.0
Sask	20.0	23.0 'b' no longer enforced	23.0	23.0
Alta	20.0	23.0	23.0 'b' ≥ 16.75 by permit	23.0
BC	20.0 23.0 'a' ≤ 5.0 (where applicable) 'b' ≤ 18.0 by special permit	20.0 23.0 - 2 articulation points	23.0	23.0
Yukon	22.0 22.5 on designated roads	22.0	special permits required	
NWT	21.5	21.5	24.4	24.4

Table 7 Allowable Combination Lengths and Conditions

- **Traffic**: the effect of vehicle length on roadway capacity and level of service.

- **Structural**: the relationship between vehicle length and load distribution as it pertains to bridge requirements.

- **Safety**: the effect of vehicle length on stability and control.

- **Public Perceptions**: the concerns about general driver attitudes to the "big truck/small car" issue.

These and other considerations have been in the minds of those responsible for establishing length limits; although, as is evident in the current regulatory situation and recent changes in it, it would appear that these considerations have not necessarily been dealt with in a logical and structured manner. The following observations provide some insight into the influences which have led to the current situation respecting length limits for A- and B-trains:

- Western Canada: The current 23-metre limit is the outcome of a series of changes initiated with the Highway Strengthening Program (a federal/provincial cost sharing program in the 1970s), where the effective use of higher GVW limits was not possible without an attendant increase in combination length limits. The higher GVW limits required the use of double-trailer combinations which generally could not be configured within a 65-foot limit. Accordingly, the limit was initially increased to 68.5 feet, then to 72 feet, and finally to 75.5 feet (23 metres as the regulations were converted to metric). This series of changes was designed to provide more-or-less equal access to the full intention of the regulations for A- and B-trains and short and long-wheelbase tractors. The rationale behind the introduction of the 16.75 metre kingpin-to-rear limit was associated with industry pressure for equal treatment of short and long-wheelbase tractors. That is, as the length limit increased, carriers using short-wheelbase tractors could accommodate more cube with long trailers than could carriers with long-wheelbase tractors. The 16.75 metre limit ended this pressure by limiting total trailer length in a combination to an effective 54 or 55 feet (ie, two 27' or a 27' plus 28' double-trailer combination).*

- This change from a 65-foot to a 23-metre limit has occurred with little hard information about the considerations listed previously; the main impetus for the change has been the industry pressure to standardize the treatment of A- and B-trains and the treatment of the adoption of the double 28-foot combination in the U.S. as a standard configuration has pressured Canadian jurisdictions to relax the 16.75-metre limit. Three provinces have modified this aspect of the regulations since the research for this study started.

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* *See Volume I for a hypothetical double 28' combination that meets both the 23 m length limit and the 16.75 m kingpin limit.*

- Ontario: The 1984 increase in combination length limits from 21 to 23 metres is the outcome of the Uffen Commission recommendations. [4] In effect the Commission said that such a change would this is true, it would be difficult to argue that Ontario had any strong technical basis for limiting lengths to 21 metres for as long as it did, even though this limit significantly influenced the types of vehicles used in the province.

- Northwest Territories: The establishment of the 24.4 metre (80') limit is revealing: apparently, certain doubles operating in the territory were 2 feet longer than the more common (in Western regulations were "rounded up" to 80 feet.

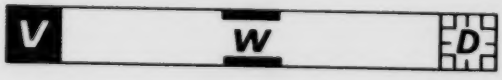
- Eastern and Central Canada: The combination length limits (with distinguish between configuration types. This suggests that the length limit on doubles is not associated with articulation concerns, in that tractor-semitrailer combinations exhibit the greatest amount of off-tracking of any combinations given a common total overall length.

The wide variation in combination-length limits does not appear to be founded on any strong technical grounds. To a large extent, these limits are probably derived primarily as a "fall-out" from limits placed on other elements or combinations of elements.

- POLICY/ENFORCEMENT PRACTICES: The practice in Manitoba and Alberta of allowing B-trains to operate at 23.0 metres even though a strict interpretation of the regulations seems to suggest that only A-trains are covered has already been noted. In three of the Western provinces, the 16.75 metre kingpin limit is no longer a limit (given non- enforcement or special permits) pending regulatory change.

- COMMENT: The issue of combination length limits in association with the 16.75 metre and the 19.0 metre limits is an important one, particularly for cube-out operations. Certain pressures can probably be anticipated. First, given the adoption of 48-foot semitrailers and 28- foot doubles in the U.S., it can be anticipated that this type of equipment will become the industry standard. This will increase the pressure on those jurisdictions in Canada where use of such equipment is not feasible given either a low combination-length limit (Atlantic Canada) or a 16.75-metre kingpin limit that make the use of 28-foot pups difficult. Second, Ontario's and Quebec's adoption of a 23 metre length limit, coupled with its unique specification of the 16.75 and 19.0 metre requirements, will further increase the pressure on other provinces, as Ontario's regulations make it easier to use 28-foot doubles.

It is also interesting to observe that the adoption of the 24.4-metre limit in the Northwest Territories is close to the point of permitting Rocky Mountain doubles under the standard regulations (currently, these doubles only operate under special permit in Canada). That is, 24.4 metres would allow the use of a 45-foot semitrailer with a 20-foot pup and a short-wheelbase tractor.



3.4 TIRE LOADS

- CURRENT REGULATIONS: Allowable tire loads are most commonly specified in terms of load-per-unit-width of tire; in only two cases are the regulations written solely in terms of the manufacturer's tire rating. In most cases the regulations consider tire loads separately from other elements; although, there are a few cases where tire loads are also a component of other elements (eg, axle loads).

- CONDITIONS: Only three provinces regulate maximum tire size or maximum tire load: the two are equivalent, given a load-per-unit-width regulation. The apparent reason for these regulations is a concern with the use of wide-base tires. Alberta had a limit for tire width of 16 inches which, given 9 kg/mm of tire width, amounted to a maximum tire load of 3,658 kg. This has recently been changed to a flat maximum 3,650 kg load per tire. In Saskatchewan, 3,000 kg per tire given 9 kg/mm, means that any tire over 13 inches is redundant*. In the Northwest Territories, tires (non-steering axles) are allowed a load of 80 kg/cm up to 25.4 cm (ie, tires of 10 inches are allowed a load of 2,032 kg); and, tires on steering axles are permitted an additional 250 kg per 2.5 cm of tire up to 35.4 (ie, front-steering tires of 14 inches are allowed a load of 3,032 kg, which in practice is rounded up to 3,250 kg.)

The conditions in Prince Edward Island for axles with single tires are complex. Whereas for dual-tire axles the regulations specify a maximum tire load of 600 lbs/inch (10.7 kg/mm), for single-tire axles the regulations specify a series of permitted loads for 10, 11, 12, and 18 inch tires given the tire diameter, the ply, and the manufacturer's tire load range. The result is that the effective tire loads on single-tire axles can range from a low of 7.94 kg/mm (using 18.00 x 22.5 tires with 14 ply and a load range "G") to a high of 12.65 kg/mm (using 12.00 x 24 tires with 18 ply and a load range "J").

- SEASONAL ASPECTS: Saskatchewan is the only province with a general seasonal provision to its tire-load regulations: 10 kg/mm from December 1 to February 28 rather than 9 kg/mm. In addition, Saskatchewan may reduce tire loads on oil-treatment secondary highways in the spring to 6.0 kg/mm on non-steering axles and to 7.0 kg/mm on front-steering axles. Manitoba has a more limited regulation to the effect that tire loads may be reduced to 6 kg/mm on some roads and 4.5 kg/mm on other roads in the spring. In New Brunswick, tire loads may be reduced in the spring: the axle rating or the sum of the permitted tire load, whichever is higher, may be reduced by 10% or 20%. In the Northwest Territories, axle loads are increased by 10% in the winter, but as axle loads are in effect set by the tire load regulations, this apparent axle-load increase is also a tire-load increase (ie, from 80 to 88 kg/mm).

- CHANGES SINCE 1970: There have been few changes to tire-load regulations. Some minor increase occurred during metric conversion; in the

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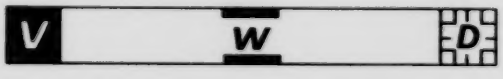
* *Strictly, a tire load of 9 kg/mm with a 3,000 kg maximum implies a maximum tire size of 333.33 mm or 13.1".*



Northwest Territories, tire loads were decreased in 1980 from 500 to 450 lbs/inch (8.93 to 8.04 kg/mm); and, in Saskatchewan, the 10 kg/mm winter load has been introduced.

- REGULATIONS IN BORDERING STATES: There is considerable diversity in tire-load regulations in bordering states. In almost all cases, however, a Canadian truck with tires wide enough to comply with Canadian regulations would have no problems with the U.S. regulations in the states closest to its home province.

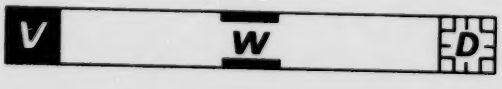
- TECHNICAL BASIS: There are two technical considerations involved in the tire-load limits: the effect of tire loads on pavements, and the load-carrying capability of the tire itself. Only four jurisdictions address this second matter in their regulations (Prince Edward Island with respect to single-axle tires, Nova Scotia, Quebec, and Alberta). At least one of these four (Alberta) has, in practice, given up trying to understand what the manufacturer's ratings mean.

It is the first of these considerations (pavements) which presumably constitutes the essential rationale behind the existing tire-load regulations. In most cases, the approach taken has been to regulate the allowed load per unit-width of tire, usually interpreted to mean the nominal width stipulated by the manufacturer. The nominal width of a tire is (theoretically) based on the "section width", which is the linear distance between the outside of the sidewalls of an inflated tire (undeformed by load). In practice, the nominal width can be up to (roughly) 20 mm more or less than the section width, depending on the model and tread design. Whatever the actual deviation between nominal width and section width, the more important point is that under loaded conditions the nominal width has no direct or consistent relationship with tread width or actual pavement contact area. Further, and even if the previous point were not true, nominal widths of tires vary from one type of tire to another even when they are made by the same manufacturer (eg, bias versus radial ply or a tire with a tube versus a tubeless tire); and, they vary even more when considering tires made by different manufacturers. Finally, once a tire has been retreaded, the nominal width becomes effectively meaningless. All of this suggests that there are significant problems associated with tire-load regulations based on load-per-unit-width limits and nominal widths.

Certain of the differences in the tire-load regulations appear to be founded on little or no technical basis. For example,

- The difference between the 10.7 and 11 kg/mm load limit appears to be simply a different approach to converting to metric units (ie, different ways of rounding 600 lbs/inch).

- The 8 kg/mm limit in the Northwest Territories has only recently been introduced and does not appear to be based on any technical consideration. There is some possibility that the Northwest Territories was under the mistaken impression that they were making their regulations more compatible with other jurisdictions when they reduced the limit from 500 to 450 lbs/inch (or 9 to 8 kg/mm).



* current regulations (kg per mm)

11	Ont, BC, Yukon
10.7	PEI, NB
10	Nfld
9	Man, Sask, Alta
8	NWT

subject to manufacturer's rating - NS, Que, Alta

* conditions

Ont, Yukon	- tires over 150 mm (9 kg/mm for smaller tires)
Alta	- lesser of allowed load/mm or rating
Sask	- max. load on any tire is 3,000 kg
Alta	- max. load on any tire is 3,650 kg
NWT	- effective max. tire size (non-steering) is 25.4 cm
	- effective max. tire size (steering) is 35.4 cm

* exception

PEI	- 7.94 to 12.65 kg/mm for single-tire axles
NWT	- effectively allows up to 9.18 kg/mm for front-steering axles

* seasonal aspects

NB	- potential spring reductions (10% or 20%)
Man	- some roads "may be" reduced to 6 kg/mm or 4.5 kg/mm in the spring
Sask	- 10 kg/mm allowed in winter on non-steering axles;
	- 6.0 to 7.0 kg/mm on some roads in spring
NWT	- effectively increases loads by 10% in winter, and may decrease loads in spring

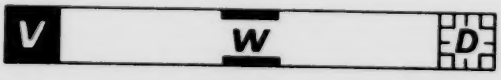
* regulations in bordering states

lbs/in	(kg/mm)	
800	(14.29)	N.Y., Penn.,Idaho
700	(12.50)	Mich.
650	(11.61)	Ohio
600	(10.72)	Maine, N.H., VT, Minn., Mont.
550	(9.82)	N.D., Wash
not known		Wisc., Alaska

Table 8 Allowable Tire Loads

- It is difficult to understand how the strict dependence on a manufacturer's rating in Quebec and Nova Scotia addresses the consideration of the effect of tire loads on pavements.

There are certain inconsistencies in the manner of applying tire-load regulations when related to axle load, seasonal aspects, and road-class aspects which blur the technical logic of existing tire load limits. Examples include,



- Three provinces increase axle-load limits in the winter without increasing tire-load limits (Ontario, Manitoba, and Alberta; see Sections 3.5 and 4.1).

- Four provinces (to various degrees) decrease axle loads on secondary highways while allowing the same tire loads as those permitted on primary highways (Nova Scotia, Ontario, Manitoba, and Saskatchewan; see Sections 3.5, 4.2, and 5.3).

The regulations also reflect varying opinions about the question of wide-base tires (there is some research that suggests that wide-base tires do more damage to pavements than comparable dual tires [5]):

- Prince Edward Island: Tires on dual-tire axles are subject to a constant load-per-unit-width regulation (10.7 kg/mm) whereas tires on single-tire axles are subject to more complex regulations which result in a range of permitted loads-per-unit-width. Wide-base tires (18 inch are the only ones permitted) are allowed loads ranging from 7.94 to 9.92 kg/mm depending on the diameter, the ply, and the manufacturer's load range.

- Ontario and the Yukon: Single-tire axles are restricted to lower loads than dual-tire axles (over and above any tire-load two 18 inch wide-base tires would be limited to 9,000 kg (9.84kg/mm), whereas an axle with four 9 inch tires would be permitted a load of 10,000 kg (10.94 kg/mm). Ontario officials suggest that one of the reasons for restricting the loads on single-tire axles is, in fact, in consideration of the effect of wide-base tires.

- Manitoba: There is no limit on tire size, but there is a policy of "discouraging" the use of wide-base tires.

- Saskatchewan: The maximum tire load is 3,000 kg, making it redundant to use tires larger than 13 inches.

- Alberta: The maximum tire load is 3,650 kg, making it redundant to use tires larger than 16 inches.

- Northwest Territories: Effective maximum tire sizes are 10 inches for non-steering axles and 14 inches for steering axles (ie, these are maximum in the sense that anything larger would be redundant).

- POLICY/ENFORCEMENT PRACTICES: The only two known instances of where policy or enforcement practices differ from the written regulations have been discussed in the previous notes: Manitoba discourages the use of wide-base tires; and, the Northwest Territories effectively rounds up the permitted load on front-steering tires.

- COMMENT: There is a great deal of diversity in tire-load regulations in Canada: the basic regulations for axles with dual tires vary from 8 to 11 kg/mm in ten jurisdictions with the remaining two permitting a load specified by the manufacturer; for single-tire axles (ie front-steering axles in most cases) permitted tire loads vary from 7.94 to 12.65 kg/mm (Prince

Edward Island having both the highest and the lowest limits); two jurisdictions have different loads for different -sized tires; one jurisdiction permits the lesser of an allowed load or the manufacturer's rating; three jurisdictions prohibit (make redundant) the use of tires over a certain size; three jurisdictions reduce (may reduce) tire loads in spring; two jurisdictions increase allowable tire loads in the winter (in one case the intent is to increase axle loads).

Despite this diversity, there is an important fact about tire loads that cannot be understood until axle loads are considered. This aspect of tire-load regulations is discussed below in Section 5.1. For here, it is sufficient to note that with important qualifications tire-load regulations become less of an issue once 10 inch or larger tires are used. That is, axle-load limits not tire-load limits generally become the constraining factor.

3.5 AXLE LOADS

Axle-load regulations are complicated in part by some differences in terminology. For here, the terms defined in the Glossary and Section 2.6 are used. Further, in the following five subsections, no consideration is given to the effect of axle spacing or tire loads. Axle spreads, however, are considered.

3.5.1 Single-Front-Steering Axles

- CURRENT REGULATIONS: Allowable loads are shown in Table 9.

- CONDITIONS: A variety of conditions are important in determining allowable single-front-steering axle loads. Manufacturer's axle rating ("axle rating" in Table 9) is a condition in one of three ways: in some provinces (eg, Manitoba) the regulations simply state that no load may exceed the axle rating; in other provinces (eg, some in Atlantic Canada) the axle rating is one of the factors determining allowable loads where the regulations permit the "lesser of" a number of factors; and in other provinces (eg, Quebec or Ontario), special certificates proving the axle rating are required for loads over a certain amount. Tire ratings and/or the load-per-unit-width-of-tire regulations are always a condition of axle loads. The distance to the next adjacent axle ("axle spacing") partially determines axle loads. Finally, seasonal and road-class considerations may affect front-steering-axle loads in some situations.

  - Atlantic Provinces: Although there are differences in wording, the regulations are all similar. The permitted load is determined from the lesser of the axle rating or the sum of the permitted tire load; and, while 4,500 kg is recognized as a more-or-less standard single-front-steering-axle load, all four provinces will permit up to 9,000 kg. In New Brunswick there is one additional factor involving a requirement for a certificate for loads over 4,500 kg for vehicles manufactured prior to December 31, 1978. In Prince Edward Island, front-axle loads vary with axle spacing -- the other three provinces simply specify a minimum spacing.

- Quebec: 5,500 kg is generally permitted. For loads higher than this, the manufacturer's axle rating is the permitted load to a maximum of 8,500 kg. "Single unit road vehicles with dumping mechanisms, back-loading refuse-compacting trucks or single unit vehicles used for public highway maintenance" are permitted up to 10,000 kg on single-front-steering axles.

- Ontario, and the Yukon: Proof of manufacturer's rating is required for loads in excess of 5,000 kg. The regulations show single-front-steering axles with loads up to 10,000 kg; however, for this to be possible, dual tires would have to be used. In Table 9, 9,000 kg is shown as the maximum as the only known front-steering axles have single tires.

- Manitoba: No load greater than the axle rating is permitted. Proof of the axle rating is required for loads in excess of 5,500 kg. As a matter of practice, the only vehicles permitted a front-axle load in excess of 5,500 kg are straight trucks (up to 7,300 kg) and special permit vehicles such as cement mixers (up to 8,190 kg).

- Saskatchewan: There are no regulations on manufacturer's ratings, and no exceptions to the 5,500 kg front axle loads (barring special permits).

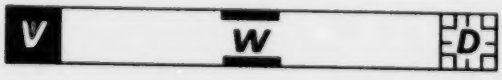
- Alberta: The regulations combine the following elements and/or conditions: number of axles, tire size, rated tire capacity, and the minimum distance to next adjacent axle.

- British Columbia: Single-front-steering-axle load regulations are the same as those for single axles. The only exception is in the case of 3-vehicle combinations where the front axle is limited to 6,000 kg.

- Northwest Territories: The effective limit on front-steering-axle loads is the tire-load regulations. These permit a maximum of 3,032 kg/tire (with 35.4 cm or 14 inch tires), which in practice is rounded to 6,500 kg for the axle.

- EXCEPTIONS: The exception shown for Newfoundland is self-explanatory, and the exceptions for Quebec and British Columbia have been dealt with in the preceding notes.

- SEASONAL ASPECTS: Allowable single-front-steering-axle loads may be reduced in the spring ("spring ban" or "reduced load period") and increased in the winter ("winter premium") in some situations. In Table 9, the intent is only to show this ("S(r)") where some primary or secondary highways may be so affected -- given the difficulties in defining these highway classes in a consistent manner across the country, there has been considerable judgement exercised in placing these symbols. More complete details are given in Section 4.1 and in the following:



* current regulations

	maximum load (kg)	conditions					
		axle rating	tire rating	spacing	season	road class	vehicle type
Nfld	9,000	*	*	*	--	--	--
PEI	9,000	*	*	*	S(r)	--	--
NS	9,000	*	*	*	S(r)	--	--
NB	9,000	**	*	*	S(r)	--	--
Que	8,500	**	*	*	S	*	*
Ont	9,000	**	*	*	W(r)S(r)	*	--
Man	8,190	**	*	*	--	--	*
Sask	5,500	--	*	*	--	--	--
Alta	7,300	--	*	*	W,S(r)	--	--
BC	9,100	--	*	*	--	--	*
Yukon	9,000	**	*	*	--	--	--
NWT	6,500	--	*	*	W,S(r)	--	--

* conditions

axle rating: * manufacturer's rating a determining factor
** proof of rating required over a certain load

tire rating: * tire rating and/or tire-load regulation is a determining factor

spacing: * spacing may determine load

season: S - lower loads in spring
S(r) - lower loads in spring in some cases
W - higher loads in winter
W(r) - higher loads in winter in some cases

road class: * different limits apply for some roads

vehicle type: * vehicle type determines load

* exceptions

Nfld - 3,200 kg if retreads used
Que - single-unit dump & garbage (10,000 kg)
BC - 3-vehicle combinations (6,000 kg)

* regulations in bordering states

12 of the states appear to apply the same regulations as those for single (non-front) axles
13,000 lb (5,896.7 kg) Mich., Wisc.

Table 9 Allowable Single-Front-Steering-Axle Loads

- Prince Edward Island: Single-front-steering axles are restricted to 10,000 lbs (4,500 kg) on some roads (non-designated) in the spring. Trucks hauling some commodities are exempted from these spring restrictions.

- Nova Scotia: Single-front-steering-axle loads are limited to 6,500 kg on secondary roads in the spring.

- New Brunswick: As discussed under tire-loads, axle loads may be reduced in the spring: the higher of the axle rating or the sum of permitted tire load may be reduced. As a practical matter, these spring restrictions are never applied to major highways (hence the "S(r)" in Table 9, even though there is an authority to restrict loads on all roads).

- Quebec: Single-front-steering axles are limited to 7,500 kg on all roads in periods of rain or thaw. (It is not clear that this is or can be enforced in all circumstances.)

- Ontario: All single axles are limited to 5,000 kg on designated roads in spring. (There are some exceptions for some truck-commodity-haul situations.) Trucks hauling raw forest products are permitted 110% loads during freeze-up.

- Alberta: It is not known whether or not steering-axle loads are increased by 10% in the winter. There may be spring reductions.

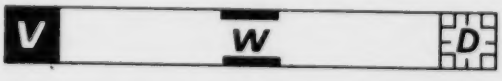
- Northwest Territories: All axle loads may be increased by 10% in the winter; there may be spring reductions (percent reductions, depending or road conditions) on paved roads in the spring. (As axle-load limits are determined from tire-load limits, these seasonal changes are effectively tire-load changes.)

- ROAD CLASS ASPECTS: In some cases, the class of road affects the allowable axle load -- the only case important enough to note being Ontario where, single-front-axle loads of only 8,200 kg are permitted on Class 'B' roads. (This ignores road-class aspects associated with seasonal considerations in other jurisdictions.)

- CHANGES SINCE 1970: Few changes in allowable front-axle loads are known. In at least one province (Saskatchewan) the conversion to metric regulations resulted in lower limits -- the old 13,000 lb limit on 13 inch tires being replaced by the current 5,500 kg (12,128 lbs) limit.

- REGULATIONS IN BORDERING STATES: Most states appear to allow the same loads on single-front-steering axles as they do on any single axles. In effect, then (see Table 10), front-axle loads in the bordering states are in the range of 9,000 to 10,000 kg (Michigan and Wisconsin being two known exceptions).

- TECHNICAL BASIS: Most provinces treat single-front-steering axles in the same manner as any other single-tire axle. The exceptions are those provinces requiring proof of an axle rating for steering axles with loads over certain amounts; Quebec which has a lower limit for front axles than for other single axles; Manitoba which also has a lower limit for front



axles than for other single axles (the 8,190 kg allowed on single-front-steering axles is the "old" 18,000 lb single-axle limit); Saskatchewan which also has a lower limit for front axles (5,500 kg versus 6,000 kg allowed on other single axles with single tires); British Columbia which restricts the front-axle load of 3-vehicle combinations; and, the Northwest Territories which allows 6,500 kg on front axles with 14 inch tires (versus 4,064 kg on 10 inch tires on other single axles with single tires). The technical basis for allowing higher, lower, or the same load on front-steering axles in comparison to other single-tire single axles is not known. According to one provincial source there was an early RTAC/CCMTA recommendation that 5,500 kg be the limit on steering axles -- it is not known if this was based on any technical information.

- POLICY/ENFORCEMENT PRACTICES: The regulations for Prince Edward Island are specified in Imperial units, and the allowable loads shown in Table 9 are not strictly accurate (ie, they should show a maximum load of 9,072 kg). However, as a matter of practice, officials in Prince Edward Island round the converted Imperial regulations to the same limits as those applied in the other Atlantic provinces. This policy is equally applicable to all subsequent discussions of allowable loads (but, is not necessarily repeated at each point). The policy in Manitoba of only allowing certain vehicles to have front-axle loads in excess of 5,500 kg has been noted.

- COMMENT: There is little uniformity on allowable single-front- steering-axle load regulations in Canada: the maximum, barring special permits, ranges from 5,500 kg (Saskatchewan) to 9,100 kg (British Columbia) or even 10,000 kg for some trucks in Quebec. Further, there are a multitude of conditions, including seasonal and road-class aspects, that add to this diversity.

3.5.2 Other-Front-Steering-Axle Loads

There are a number of other-front-steering axles recognized in the regulations of some provinces. The most common of these is the tandem- front-steering axle with wide-base single tires, most commonly seen on dump, cement, and other types of construction trucks.

- Newfoundland, Nova Scotia, New Brunswick, and Quebec: Tandem-front-steering axles of up to 17,000 kg are permitted.

- Prince Edward Island: The regulations do not recognize any other front or steering axles.

- Ontario, and the Yukon: The regulations recognize tandem- and triple-front axles which are allowed the same load as any other tandem or triple axles. Given that front axles generally have single tires, there is a slight reduction in the allowable loads from the more typical dual-tire tandem and triple axle loadings.

- Manitoba: The permitted load on a tandem-front-steering axle is the same as any tandem axle (16,000 kg), given adequate tires.

- Saskatchewan: Tandem-front-steering axles are permitted a load of 11,000 kg (two times the allowed single-front-steering axle load).

- Alberta: The regulations allow for tandem-front-steering axles with a load of 13,600 kg.

- British Columbia: The permitted load on a tandem-front-steering axle is the same as for any two adjacent axles (17,000 kg), given adequate tires.

- Northwest Territories: The permitted load on a tandem-front-steering axle is 12,128 kg (four times the front-tire load limit, given 14" tires). This may be rounded in practice to 2 X 6,500 kg.

3.5.3 Single Axles

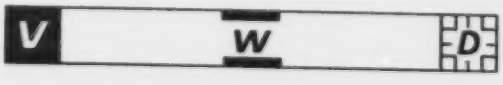
- CURRENT REGULATIONS: The regulations are shown in Table 10.

- CONDITIONS: The conditions associated with single-axle load limits are similar to those for single-front-steering axles. One minor difference concerns the requirement in some provinces for having proof of manufacturer's axle rating for loads over a certain amount: this does not apply to single (non-front) axles. In the Atlantic provinces, however, the single-axle loads must still fall within the manufacturer's rating; while specific regulations on this point are not known in the other provinces, it is assumed that appropriate axle ratings may be a condition of any axle loadings. Another difference concerns the requirement for dual tires (not an issue for front-steering axles): in some provinces, the loads shown in Table 10 are only possible for axles with dual tires (as shown). This may arise for a number of reasons: in two jurisdictions (Ontario and the Yukon), lower limits govern single-tire axles (9,000 kg versus the 10,000 kg shown in Table 10); and, in three jurisdictions (Saskatchewan, Alberta, and the Northwest Territories), the tire-load regulations which either limit tire size or tire load effectively mean that the loads shown in Table 10 are only possible with dual tires.

- SEASONAL ASPECTS: Single-axle load limits may be increased in the winter and reduced in the spring in some situations. Most of the seasonal aspects to single-axle load limits are identical to those for single-front-steering axles: see the previous subsection for details concerning all provinces except the following four:

  - Quebec: Single axles are limited to 8,000 kg on all roads during periods of rain or thaw. (Steering axles are limited to 7,500 kg.)

  - Manitoba: Single-axle limits are increased by 10% on primary and secondary highways in the winter (steering-axle limits are not). There may be some tire-load reductions on some roads in the spring (which



* current regulations

	maximum load (kg)	conditions					
		tire rating	number of tires	spacing	season	road class	vehicle type
Nfld	9,000	*	--	*	--	--	--
PEI	9,000	*	--	*	S(r)	--	--
NS	9,000	*	--	*	S(r)	--	--
NB	9,000	*	--	*	S(r)	--	--
Que	10,000	*	--	*	S	--	--
Ont	10,000	*	4	*	W(r)S(r)	*	--
Man	9,100	*	--	*	W(r)	*	--
Sask	9,100	*	4	*	W	*	--
Alta	9,100	*	4	*	W,S(r)	--	--
BC	9,100	*	--	*	--	--	*
Yukon	10,000	*	4	*	--	--	--
NWT	8,128	*	4	*	W,S(r)	--	--

* conditions

tire rating: * tire rating and/or tire-load regulation is a determining factor

# of tires: 4 - dual tires necessary (for load shown)

spacing: * spacing may determine load

season: S - lower loads in spring
S(r) - lower loads in spring in some cases
W - higher loads in winter
W(r) - higher loads in winter in some cases

road class: * different limits apply for some roads

vehicle type: * vehicle type determines load

* exceptions

some provinces allow higher loads for special single axles (eg 8-wheel axles for lowbeds)
BC allows 9,600 kg for logging trucks

* changes since 1970

most provinces have increased by 835 - 935 kg
Que & Ont have increased by 1,835 kg
NWT has lowered limits from 9,000 to 8,128 kg (1982)

* regulations in bordering states

22,400 lb	(10,160 kg)	N.H., VT, N.Y., Penn
22,000 lb	(9,979 kg)	Maine
20,000 lb	(9,072 kg)	9 other bordering states

Table 10 Allowable Single-Axle Loads

may result in axle load reductions). As to whether or not there are axle-load reductions in the spring, there are conflicting views.

- Saskatchewan: Load limits for single axles are increased by 10% in the winter over the allowable primary highway limit. The effect is that while axle loads may increase by 10% on the primary roads, they may increase by over 20% on secondary roads. (Steering-axle-load limits are not increased.)

- British Columbia: Although no spring reductions are shown in Table 10 (or subsequent axle-load tables), there may be spring restrictions on secondary roads.

- ROAD CLASS ASPECTS: The maximum loads shown in Table 10 are permitted (where indicated "*") on primary highways. In Ontario, Manitoba, and Saskatchewan, single-axle loads of only 8,200 kg are permitted on secondary roads. (This excludes any consideration of road-class aspects that arise in conjunction with seasonal aspects.)

- CHANGES SINCE 1970: In 1970, the standard across the country was 18,000 lbs (8,165 kg) on a single axle. Since then, allowable loads have been increased 835 kg (Atlantic), 935 kg (west), and 1,835 kg (Quebec and Ontario). The exception is the Northwest Territories where single-axle load limits have been lowered from 9,000 kg to 8,128 kg.

- REGULATIONS IN BORDERING STATES: Single-axle load limits in bordering states are similar to those in Canada; most trucks on both sides of the border are limited to the range of 9,000 to 10,000 kg or 20,000 to 22,400 lbs.

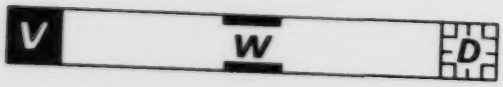
- COMMENT: There is little uniformity in the single-axle load regulations: the maximum standard limit varies from a low of 8,128 kg (Northwest Territories) to a high of 10,000 kg (Quebec and Ontario). Further aspects of the differences are analyzed in Section 5.3.

3.5.4 Tandem Axles

- CURRENT REGULATIONS: Allowed loads are shown in Table 11.

- CONDITIONS: Some of the conditions affecting the allowed loads on tandem-axles are similar to those for single axles (tire-rating and/or tire-load regulations, seasonal aspects, road-class aspects). In addition, there are a number of other points to note about tandem-axles:

  - Definitions: The definition of a tandem axle (or whatever term is used in the regulations) conditions its use. For example, in some provinces there are precise definitions in terms of the maximum/minimum spreads, the use of equal-size tires, the load-equalization properties, the requirement for brakes, etc. One of the difficulties in comparing the regulations in one province with those in another is that some-



* curent regulations

	maximum load	conditions					
		minimum spread	tires #	tires *	vehicle type	season	road class
	kg						
Nfld	18,000	1.8	-	*	tr,s	-	-
PEI	18,000	1.8	-	*	tr,s	S(r)	-
NS	18,000	1.8	-	*	tr,s	S(r)	*
NB	18,000	1.8	-	*	tr,s	S(r)	-
Que	20,000	2.4	-	*	-	S	-
Ont	19,100	1.8	8	*	-	W(r) S(r)	*
Man	16,000	1.0 to 2.0	-	*	-	W(r)	*
Sask	16,000	1.0 to 2.0	8	*	-	W	*
Alta	16,800	2.4	8	*	-	W, S(r)	-
BC	17,000	1.5 to 1.85	-	*	-	-	-
Yukon	19,100	1.8	8	*	-	-	-
NWT	16,256	-	8	*	-	W, S(r)	-

* conditions

spread: max. load requires the minimum spread indicated
tires: 8 - dual tires necessary for load shown
* tire rating and/or tire-load regulation
vehicle type: "tr", "S" - load permitted for trailer or semitrailer only
season: S - lower loads in spring
S(r) - lower loads in spring in some cases
W - higher loads in winter
W(r) - higher loads in winter in some cases
road class: * load shown permitted on primary roads

* exceptions

Que - spread requirements for some trucks

* changes since 1970

limits have increased from 1,485 kg to 6,392 kg, except in NWT where the limit increased by 356 kg

* regulations in bordering states

36,000 lb (16,329 kg) N.H., VT, N.Y., Penn.
34,000 lb (15,422 kg) remaining 10 bordering states

Table 11 Allowable Tandem-Axle Loads

times only a part of the terms covering the definition of a tandem is actually included in the formal definition. For example, in some provinces it is necessary to incorporate parts of other definitions ("axle", etc.) or other parts of the regulations (eg, regulations on tire loads to determine that dual tires are required). The characteristics of tandem axles, drawing on all parts of the regulations, are shown in Table 12.

- Tires: Conditions pertaining to tire size or rating have been described in Section 3.4. In some cases, dual-tire tandems are necessary for maximum tandem loads.

- Axle Spacing: In most cases, tandem axles must be a certain minimum distance from other axles before the maximum loads are allowed. This subject is considered in Section 3.6 and in Part 5.

- Vehicle Type: In the Atlantic provinces, different maximum loads are allowed depending on the vehicle type (power units versus non-power units). In Table 11, the maximum loads shown for these provinces are for trailers or semitrailers. In Table 13, the loads and spreads shown are for both power units and non-power units, except that the highest load is only allowed on non-power units.

- Tandem Spread: In most provinces it is necessary to have a certain minimum axle spread for the maximum load. These largest minimum spreads are shown in Table 11 (ie, the largest minimum spread is necessary to achieve the maximum loading). Some provinces (Quebec) exempt certain trucks from these conditions; other provinces (Manitoba and Saskatchewan) only have one spread requirement (1.0 to 2.0 m) as compared to the more common practice of a series of spreads with a corresponding series of allowed loads; and one jurisdiction (the Northwest Territories) has no minimum spread condition. Variations in load limits as a function of spread are shown in Table 13: the load shown at a particular spread is the allowed load until, reading down the column, the next figure shown. In the case of Prince Edward Island, there is a difference in the figures shown in Table 11 versus those shown in Table 13: in Table 11, the spread and the load have been converted to metric units comparable to the other Atlantic provinces; in Table 13, the actual Imperial units from the regulations have been converted to metric (eg, 40,000 lbs with a spread of 72 inches is shown as 18,144 kg at 1.83 m).

- SEASONAL ASPECTS: The seasonal aspects of allowable tandem-axle loads are similar to those for single-axles (ie, in terms of when and how spring or winter load limits apply; not in the allowable load).

- ROAD CLASS ASPECTS: The road class aspects of allowable tandem-axle loads are also similar to those discussed for single axles, although there are a few slight differences. Nova Scotia (which does not differentiate single-axle load limits by road class) has a higher tandem- axle load on its

primary roads than it does on its secondary (18,000 kg versus 17,000 kg). Ontario, Manitoba, and Saskatchewan all have secondary roads where lower tandem-axle-load limits apply (16,400 kg in Ontario or 11,000 kg if the spread is less than 2.4 m; 14,500 or 8,200 kg in Manitoba depending on the road class; and, 14,500 kg in Saskatchewan).

- CHANGES SINCE 1970 : Allowable loads have increased from 32,000 lbs (14,515 kg) in 1970 (the only exception being Quebec which was lower) to the levels shown in Table 11. These increases of anywhere from 1,485 kg on the Prairies to as much as 6,392 kg in Quebec are 10% (Prairies) to 47% (Quebec) higher than the allowable loads in 1970.

- REGULATIONS IN BORDERING STATES: Allowable tandem-axle loads in bordering states are similar to those in the Prairie provinces, and significantly lower than in other regions of Canada.

- TECHNICAL BASIS: One of the prime considerations regarding tandem axles is the load allowed for different spreads. The provinces have adopted different policies on this (see Table 13), and this is a subject that has been studied by RTAC/CCMTA. Although there are conflicting opinions, there is (was) a widely-held view that tandems with a greater spread do less damage to pavements than tandems with smaller spreads (given a constant load). The issue of tandem spreads may also be related to bridge impacts, although whether this or the pavement considerations gave rise to current practices is not known. In any case, the RTAC/CCMTA study reached the following conclusion on this issue:

  > "Under the same range of loads, the potential damaging effects of tandem axles spaced 1.2 m (48"), 1.5 m (60") and 1.8 m (72") appears to be approximately the same. For particular sites tested in the program, reductions in damaging effect were observed with increasing axle [spread], but in general it was not possible to establish a correlation between axle spread (within the range tested) and damaging effect." [6]

- POLICY/ENFORCEMENT PRACTICES: One aspect of the regulations difficult to document is the extent to which the spread requirement are actually enforced -- particularly for some types of trucks (dump trucks, and others working in and around urban centres). Some provinces concede that enforcement is "loose". Quebec recognizes the difficulty by exempting some of them from the spread requirements. Further, it is understood that there may be a problem in enforcing the load-equalization aspects of tandem axles. In particular, even if the axles appear to equalize a load when weighed at a stationary scale, this may be poorly related to its ability to equalize when in motion.

- COMMENT: The differences between the allowable tandem-axle loads constitutes a significant area of non-uniformity. As shown in Table 13, the

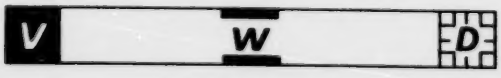
Nfld	-	axle group"; load equalization; same tire size/capacity; brakes on both axles.
PEI	-	2 consecutive axles; 2 or more tires of equal size; spread being from 1.22 to 2.44 m; load equalization, brakes on both axles.
NS	-	2 consecutive axles; load equalization; brakes on both axles.
NB	-	2 consecutive axles; spread at least 1.2 m; load equalization; equal-sized tires; brakes on both axles.
Que	-	2 axles; load equalization of "about 1,000" kg (load penalties for spreads less than 1.0 m mean in effect that tandems must have spread of at least 1.0 m).
Ont	-	"dual axle"; 2 consecutive axles; spread greater than 1.0 m load equalization.
Man	-	"2-axle group"; load equalization; spread between 1.0-2.0 m.
Sask	-	2 (or more) consecutive axles; spread between 1.0 - 2.0 m.
Alta	-	2 (or more) consecutive axles; spread between 1.0 - 2.4 m; load equalization.
BC	-	2 axles; spread between 1.0 - 1.85 m.
Yukon	-	same as Ontario.
NWT	-	2 consecutive axles.

Table 12 Characteristics of Tandem Axles

difference in allowed loads become greater as spread increases. That is, at a spread of 1.2 metres, loads vary from 16,000 kg (Atlantic and Prairie provinces) to 17,500 kg (Quebec), a difference of 9%. At a 1.8 metre spread, loads vary from 16,000 kg (Manitoba and Saskatchewan) to 19,100 kg (Ontario and the Yukon), a difference of 19%.

3.5.5 Triple Axles

- CURRENT REGULATIONS: Allowed loads are shown in Table 14. The regulations discussed in this section are for triple axles; not consider- ed are three-axle groups or tri-axles consisting of a tandem and a single (often an air-lift single). Second, some provinces in the west are described as "not recognizing triples". It should be noted that strictly the regulations in some of these provinces (Manitoba) do "recognize" triples in the sense of defining them and permitting their use. In other provinces



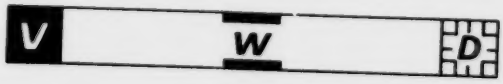
spread (metres)	Permitted Load (in 1,000 kg)											
	Nfld	PEI	NS	NB	Que	Ont	Man	Sask	Alta	BC	YU	NWT
0-.99	-NP-	-NP-	-NP-	-NP-	S	S	S	S	-NP-	S	S	16.2
1.0					17.5		16.0	16.0	16.0	16.5		
1.1						15.4					15.4	
1.2	16.0		16.0	16.0		16.8					16.8	
1.3		15.9				17.2					17.2	
1.4	16.5	16.3	16.5	16.5		17.5					17.5	
1.5	17.0		17.0	17.0	18.0	17.9				17.0	17.9	
1.6		17.0				18.3					18.3	
1.7						18.7					18.7	
1.8	18.0		18.0	18.0	19.0	19.1			16.4		19.1	
1.9		18.1								2xS		
2.0												
2.1							-NP-	2xS				
2.2												
2.3												
2.4					20.0							
2.5									16.8			
2.6+									2xS			

NOTES:
NP = not permitted
S = treated as a single axle
2xS = treated as 2 singles

Table 13 Tandem Axles: Load versus Spread

(Saskatchewan and Alberta) there is no definition of a triple, but the concept is incorporated in the definition of a "tandem axle group" (ie, two or more axles with a spread of 1.0 m to 2.0 m). The key point is that triples are only allowed the same load as a tandem.

- CONDITIONS: The conditions governing the loading of triple axles are similar to those governing tandems. That is, definitions are important (the characteristics are shown in Table 15); tire-load regulations must be observed; axle spacing affects allowable loads; and, vehicle type is a condition in that triples are restricted to non-power units in the Atlantic provinces. Axle spread is also a determinate of the permitted load: in Table 14, the minimum spread requirements (for the maximum load) are shown from the perspective of looking at a vehicle from front to back; in Table 16, the permitted loads as a function of outer spreads (axle #1 - #3) are shown. In most cases the inner spreads are equal; although this is only a specified condition in some provinces. In Atlantic Canada, there is no requirement that inner spreads be equal, and, in fact, in Prince Edward Island, for some triple axles, the only inner spreads recognized are unequal.



* current regulations

	maximum load (kg)	spread between axle			# of tires	vehicle type
		#1-2	#2-3	#1-3		
Nfld	27,000	--	1.8	4.8	–	tr,s
PEI	27,000	3.05	1.83	--	–	tr,s
NS	27,000	--	1.8	4.85	–	tr,s
NB	27,000	--	1.8	4.8	–	tr,s
Que	30,000	2.4	2.4	4.8	–	s
Ont	28,600	2.4	2.4	4.8	12	–
Man	16,000	(same as tandem axle)				
Sask	16,000	(same as tandem axle)				
Alta	16,800	(same as tandem axle)				
BC	17,000	(same as tandem axle)				
Yukon	28,600	2.4	2.4	4.8	12	–
NWT	16,256	(same as tandem axle)				

* conditions
  general conditions include tire width (or rating), number of tires, axle spread, axle spacing, vehicle type

* exceptions
  Que - spread requirements for some trucks

* seasonal aspects
  some lower (spring) & higher (winter) loads allowed

* road class aspects
  NS, Ont have lower loads for secondary roads

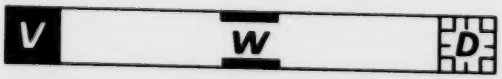
* changes since 1970
  only one province "recognized" triples

* regulations in bordering states
  4 states allow loads of between 19,051 - 24,494 kg

Table 14 Allowable Triple-Axle Loads

- Newfoundland, Nova Scotia, and New Brunswick: The maximum load (27,000 kg) is permitted where the outer spread is 4.8 metres (4.85 in Nova Scotia) and the minimum inner spread is 1.8 metres. Three other triple-axle configurations are recognized, with progressively smaller spreads and lower loads. The regulations do not to distinguish between triple axles and tri-axles.

- Prince Edward Island: Regulations are similar to those in the other Atlantic provinces; however, the regulated spreads are between the



first and second axle and the second and third axle. The regulations are in Imperial units: the maximum load (60,000 lbs) is rounded in practice to 27,000 kg. In Table 16, the allowed loads have been converted exactly to metric equivalents.

- Quebec: Five of the 25 axle types recognized in the regulations are triple axles; these permit loadings of 20,000 to 30,000 kg depending on outer spreads of from 2.4 to over 4.8 metres (the axles must be equally spaced).

- Ontario, and the Yukon: Triple-axle loads are determined from a table showing 23 gradations of outer spreads from 2.0 to over 4.8 metres with the permitted load varying from 19,500 to 28,600 kg. Axles must be equally spaced, and triple axles with single tires are limited to 27,000 kg.

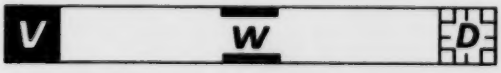
- British Columbia: As with the Prairies, triple axles are not formally recognized under the regulations. However, and unlike the Prairies, there are important tri-axles allowed under the regulations, with loadings of up to 26,100 kg.

- SEASONAL ASPECTS: The seasonal aspects of triple-axle loads (where and when they apply) are similar to those for single and tandem axles (the allowable loads, of course, differ).

- ROAD CLASS ASPECTS: Excluding the Prairies, British Columbia, and the Northwest Territories (where triples are the same as tandems), the road-class aspects of triple axles are as follows: Nova Scotia restricts triples to the same limit as tandems on secondary roads (17,000 kg); and Ontario restricts triples to 24,600 kg on its secondary roads (or 16,500 kg if the inner spreads are less than 2.4 m).

- CHANGES SINCE 1970: The regulations on triple axles in 1970 are unclear. As far as is known, Ontario was the only province which recognized them in the sense that it allowed a load higher than a tandem load. The original allowable load in Ontario was 40,000 lbs (18,144 kg), which, in December of 1969 was lowered to 32,000 lbs (14,515 kg). In 1971, the bridge formula was introduced to Ontario which then allowed substantially higher loads on triple axles. The approximate dates when other provinces "recognized" triples is as follows (special permits may have accommodated triples prior to these dates): 1973 - Quebec, and the Yukon; 1974 - possibly New Brunswick (on select highways); 1979 - Nova Scotia; 1980 - Newfoundland and Prince Edward Island. The Prairie provinces, British Columbia, and the Northwest Territories still do not "recognize" triples in the sense of providing them with a load advantage relative to tandems.

- REGULATIONS IN BORDERING STATES: Regulations on triple axles are only known for four of the bordering states: Maine at 21,772 kg; Vermont at 24,494 kg; Ohio at 21,772 kg; and Alaska at 19,051 kg.

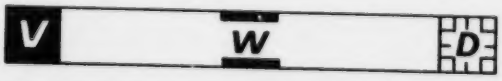


Nfld	- "axle group"; load equalization; tires of equal size/capacity; brakes on all axles; only permitted on trailers & semitrailers.
PEI	- 3 consecutive axles; 2 or more tires of equal size; inner spreads greater than 1.02 m; load equalization; brakes on both axles; only permitted on trailers & semitrailers.
NS	- 3 consecutive axles; load equalization; brakes on each axle; only permitted on trailers & semitrailers.
NB	- 3 consecutive axles; outer spread at least 2.4 m; load equalization; equal-sized tires; brakes on each axle; only permitted on trailers & semitrailers.
Que	- 3 equally-spaced axles; load equalization of "about 1,000" kg; effective minimum outer spread of 2.4 m; only permitted on semitrailers.
Ont	- 3 equally-spaced consecutive axles; minimum inner spreads 1.01 m; load equalization.
Man	- "axle group"; load equalization; maximum outer spread of 3 m
Sask	- not defined (although incorporated into the definition of a tandem-axle group).
Alta	- not defined (although incorporated into the definition of a tandem-axle group).
BC	- not defined (but is treated as a tandem axle if the outer spread is less than 1.85 m).
Yukon	- same as Ontario.
NWT	- not defined (but is treated as a tandem axle if 2 of the axles are within 1.85 m).

Table 15 Characteristics of Triple Axles

- TECHNICAL BASIS: There are two technical conflicts apparent in the regulations governing triple-axle loads. The first involves differences of opinion on loads which should be permitted as a function of spread (see Table 16). Again, as with tandem axles, this issue was investigated in the RTAC/CCMTA study with no findings that could be used to support any of these views:

  "As was observed with tandem axle groups, there were particular pavement structures which exhibited consis-



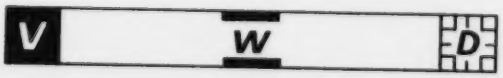
tently lower responses to the wider spread [triple axle], but in general, a correlation between axle [spread] and potential damaging effect could not be drawn (for the range of [spreads] tested)." [7]

outer spread (metres)	Permitted Load (in 1,000 kg)											
	Nfld	PEI	NS	NB	Que	Ont	Man	Sask	Alta	BC	YU	NWT
0 - 1.99	-NP-	-NP-	-NP-	-NP-	17.5	-NP-	16.0	16.0	16.4	17.0	-NP-	16.2
2.0										-NP-		
2.1						19.5		(2)			19.5	
2.2												
2.3												
2.4	20.5		20.5	20.5	20.0	21.3			16.8		21.3	
2.5		20.4							(1)			
2.6												
2.7												
2.8						21.7					21.7	
2.9						22.0					22.0	
3.0					22.0	22.4	-NP-				22.4	
3.1						22.7					22.7	
3.2						23.1					23.1	
3.3						23.4					23.4	
3.4						23.8					23.8	
3.5						24.1					24.1	
3.6					25.0	24.4					24.4	
3.7	22.5	22.7	22.5	22.5		24.8					24.8	
3.8						25.1					25.1	
3.9						25.5					25.5	
4.0						25.8					25.8	
4.1						26.2					26.2	
4.2					27.0	26.5					26.5	
4.3	25.0	24.9	25.0	25.0		26.9					26.9	
4.4						27.2					27.2	
4.5						27.6					27.6	
4.6						27.9					27.9	
4.7						28.3					28.3	
4.8	27.0			27.0	30.0	28.6					28.6	
4.9		27.2	27.0									
5.0												

NOTES:

NP = not permitted
(1) = not permitted, but treated as a tandem
(2) = considered the same as a tandem

Table 16 Triple Axles: Load versus Spread



The second conflict involves differences of opinion in the acceptability of operating three consecutive fixed axles in the first place (irrespective of their *load*). Regulations (or policies) in the western provinces are designed to prohibit (or discourage) the use of three consecutive fixed axles, if the outer spread is greater than a particular distance. At outer spreads of greater than 3 metres in Manitoba and 1.85 metres in British Columbia such axle groups are not permitted (ie, beyond these spreads one of the axles would have to be self-steering). Saskatchewan and Alberta simply discourage the use of such axle groups if the outer spread is greater than the allowable spreads on tandems (which is always the case).

- POLICY/ENFORCEMENT PRACTICES: In Prince Edward Island, a tandem axle plus a third air-lift axle is treated as a triple axle (ie, in terms of axle spreads and permitted loads). (In a number of other provinces, this is treated as a 3-axle group).

- COMMENT: The "non-recognition" of triples and the different loads allowed in those jurisdiction which permit their use is a significant area of non-uniformity.

3.6 GROSS VEHICLE WEIGHT

- CURRENT REGULATIONS: Maximum loads (GVW) are shown in Table 17. These depend on the number of axles and/or permitted axle loads; front-axle load (as distinct from the more general consideration of other axles); tire-load regulations; axle spacing; truck/configuration type; season; road-class; and, in some cases, special rules. The following notes describe the method of determining allowable GVWs. The subject of tolerances is excluded from this discussion (see Section 4.3), and more analysis of the differences in GVW limits is given in Part 5

- **Newfoundland**: Maximum GVWs are specified on a schedule showing 13 basic situations which further sub-divide into 19 possible truck or combination types (see Table 18). These 19 possibilities vary according to the truck/combination type, the number of axles, and the axle spacing; there are no seasonal or road-class aspects to these regulations. The schedules show front-axle loads of 4,500 kg, (except in the case of a 16,000 kg tandem-front-steering axle); the result is that in those cases where higher front-steering axles are used, the additional weight (over 4,500) must be deducted from some other axle (or else the maximum GVW for that particular vehicle type would be exceeded). The only train shown in these schedules is a B-train.

- **Prince Edward Island**: Maximum GVWs are determined from a series of eight tables showing eight truck or combination types (no doubles are included). For each type, a range of allowed GVWs is shown as a function of axle spreads and spacings. Although the regulations are similar to those elsewhere in Atlantic Canada, there are two points that differ (aside from the obvious absence of as many combination types and the use of Imperial units). First, the allowed GVWs show front-axle loads up to the

* current regulations: maximum GVW (kg)

NFld	52,500
PEI	53,500
NS	50,000
NB	56,500
Que	57,500
Ont	63,500
Man	56,500
Sask	53,500
Alta	53,500
BC	63,500
Yukon	63,500
NWT	54,500

* changes since 1970
  increases have ranged from 10,883 - 30,052 kg

* regulations in bordering states

80,000 lbs	(36,287 kg)	- 10 states
105,000 lbs	(47,854 kg)	- N.D., Mich. (some circumstances)
109,000 lbs	(49,442 kg)	- Alaska
149,000 lbs	(67,585 kg)	- Mich.

Table 17 Allowable Gross Vehicle Weights

maximum possible of 20,000 lbs (rounded in practice to 9,000 kg). Second, the axle-spacing conditions differ from the other Atlantic provinces: whereas in the other provinces, and in Prince Edward Island in some cases, the axle-spacing component of the GVW regulations are stated simply as minimum requirements, in Prince Edward Island the front-axle- to-next-adjacent-axle spacing is treated as a variable. That is, the greater the spacing, the higher the front-axle load, and the higher the GVW. In terms of seasonal and road-class considerations, the allowable GVW on secondary highways is not reduced in the spring; however, the effect of the lower axle loads is to reduce the allowable GVW for the largest of the eight combination types shown on the schedule to 32,000 kg (5 axles at 12,000 lbs and 1 axle at 10,000 lbs).

- **Nova Scotia**: Maximum GVWs are determined from a schedule showing 13 situations and 19 possible truck or combination types (see Table 18). The format is identical to Newfoundland's. The schedule is further subdivided by the allowed loads on primary and secondary highways: on secondary highways the maximum GVW is 38,500 kg. As in Newfoundland, maximum GVWs are based on 4,500 kg front-axle loads (ie, other than for tandem-front axles). Unlike the situation in Newfoundland, where front-axle loads in excess of 4,500 kg are used in Nova Scotia, the additional weight can be added to the permitted GVW, except that in no

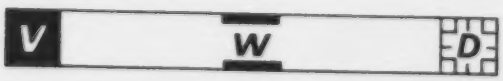
case can the total exceed the maximum GVW for a particular highway class. As in Newfoundland, the only train shown is a B-train.

- **New Brunswick**: The format, 19 truck or combination types, is identical to that in Newfoundland and Nova Scotia (see Table 18). The one difference is that the allowed GVWs are specified in terms of ranges which vary according to the loads permitted on tandem or triple axles, given certain spreads. (This is not an important difference as the GVWs shown in the schedules of the other two provinces would have to be decreased from the figures shown if the spreads were less than the largest minimum spreads applicable.) As in the other two provinces, the allowed GVWs are based on 4,500 kg front axles, excluding the tandem- fronts; as in Nova Scotia (but not Newfoundland), where higher front-axle loads are used the additional weight may be added to the allowed GVW, up to the maximum GVW for a particular highway class. Again, the only train shown is a B-train. In terms of road class, New Brunswick has three maximum GVWs: 56,500, 50,000, and 38,500 kg. The particular roads included in any one of these three class varies from year to year; in practice once a road has been up-graded, it is never down-graded.

- **Atlantic Canada**: To summarize the method used to determine allowable GVWs, the permitted combination types and spacing requirements are shown in Table 18 and an example of the determination of allowable GVW is given in Table 19 (the standard five-axle tractor semitrailer). In Table 18, truck or combination types are designated with the symbols "3-S2" (the standard five-axle tractor-semitrailer) "2-3" (a two-axle truck with a three axle trailer) and so on. Axles are shown as "o", or "o-o" in the case of a tandem, or "o-o-o" in the case of a triple; and, spacings in Table 18 are shown as "a", "b", or "c".

Without introducing a full discussion of all of the conditions and some other factors (tolerances, road class, season, etc.), there are some observations to make about the information shown in these two tables:

- First, the information shown for Prince Edward Island has to be interpreted differently than for the other three provinces. In Table 18, a range of distances shown for spacings is not the same as "the minimum spacing" specified in the other provinces (or, in some cases, in Prince Edward Island itself). Rather, these ranges are different spacings for different loadings. A single asterisk in Table 18 means the same spacing requirements exist as for the two-axle truck; two asterisks indicate the same spacing requirements as for the three-axle truck. All lines shown with a dash for Prince Edward Island require special permits. The Imperial measures used result in some awkward figures in Table 18 and 19; in practice, the axle loads and the total GVW are rounded to the same values shown for the other provinces. It is not known if this same practice is used for the spreads and spacings. (One combination type, a 2-S3, shown in Prince Edward Island's regulations but not in the other three provinces, has been omitted from Table 18.)

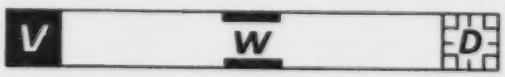


- Second, the major difference between Prince Edward Island and the other three provinces is that the regulations encompass the possibility of maximum front-axle loads, conditional on spacing requirements (2.54 to 3.66 m for the 3-S2 shown in Table 19) and assuming appropriate tire and axle ratings.

- Third, the allowable maximum GVW in Newfoundland exceeds the sum of the axle loads shown (eg, 39,500 kg versus 36,500 kg in the example shown in Table 19). The difference (3,000 kg) allows for higher tandem-axle loads (1,000 kg on the tractor tandems and 2,000 kg on the semi-trailer tandems, given appropriate spreads) or higher front-axle loads.

truck type			Nfld	PEI	NS	NB
1.	2-axle truck	o a o a	2.4	2.44-	2.4	2.4
					3.51	
2.	3-axle truck	o a o-o a	2.4	2.54-	2.4	2.4
					3.66	
3.	4-axle truck	o-o a o-o a	3.34	-	3.3	4.25
4.	2-S1, or 2-1	o a o b o a	2.4	*	2.4	2.4
		b	2.4	2.44	2.4	2.4
5.	2-S2, or 2-2	o a o b o-o a	2.4	*	2.4	2.4
		b	3.65	2.74	3.65	3.65
6.	3-S1, or 3-1	o a o-o b o a	2.4	**	2.4	2.4
		b	3.65	3.05	3.65	3.65
7.	3-S2, or 3-2	o a o-o b o-o a	3.05	**	3.0	3.0
		b	3.65	3.66	3.65	3.65
8.	3-S3	o a o-o b o-o-o a	3.05	**	3.0	3.3
		b	4.25	3.66-	4.25	4.25
				4.27		
9.	2-S1-S1, or 2-2	o a o b o c o a	3.05	-	3.0	3.0
		b	2.4	-	2.4	2.4
		c	2.4	-	2.4	3.0
10.	2-3	o a o b o c o-o a	3.65	-	3.65	3.65
		b	2.4	-	2.4	2.4
		c	3.65	-	3.65	3.65
11.	3-2	o a o-o b o c o a	3.65	-	3.65	3.65
		b	2.4	-	2.4	2.4
				-	or	
				-	3.0	
		c	3.65	-	3.65	4.25
12.	3.3	o a o-o b o c o-o a	4.25	-	4.25	3.65
		b	3.05	-	3.0	3.0
		c	4.25	-	4.25	4.25
13.	3-S2-S2, or 3-4	o a o-o b o-o c o-o a	3.04	-	3.0	3.0
		b	4.25	-	4.25	4.8
		c	4.25	-	4.25	4.8

Table 18 Atlantic Canada: Spacing Requirements



- Fourth, in considering front-axle loads, and assuming a five-axle tractor semitrailer would be registered with a 9,000 kg front axle (unrealistic), Prince Edward Island includes the possibility of 9,000 kg front axles in the GVW schedules; Nova Scotia and New Brunswick do not, but would allow this particular combination to register up to 44,000 kg (ie, add the additional 4,500 kg to the GVWs shown); and, Newfoundland would permit the higher front-axle load but would not permit the GVW to exceed 39,500 kg.

	maximum GVW (kg)	Spreads, Spacing, Axle-Loads (1,000 kg)	tractor o	tractor o--o	semitrailer	semitrailer o--o
Nfld	39,500	spreads		1.2		1.2
		spacing	3.05 +	|	3.65 +	|
		axle loads	4.5	16		16
PEI	36,287	spreads		1.22		1.22
	to	-to		-1.52		-1.83
	44,225	spacing	2.54	|	3.66 +	|
		-to	3.66 +	|		
		axle loads	4.5	15.9		15.9
		-to	9.1	17.0		18.1
NS	39,500	spreads		1.5		1.8
		spacing	3.00 +	|	3.65 +	|
		axle loads	4.5	17		18
NB	36,500	spreads		1.2		1.2
	to	-to		1.5		1.8
	39,500	spacing	3.00 +	|	3.65 +	|
		axle loads	4.5	16		16
		-to	4.5	17		18

Table 19 Atlantic Canada: Method Used to Determine GVW

- Fifth, while spacing requirements for three of the provinces shown in Table 18 are similar, there are some small differences. New Brunswick requires a minimum spacing of 4.25 metres for four-axle trucks (#3 in Table 18), versus 3.3 or 3.34 metres in the other two provinces. New Brunswick also requires slightly longer spacings for the 3-S3, and the 3-2 combinations; but, requires slightly shorter spacings for the three-axle trailer in the 3-3 combination. Nova Scotia actually has two different spacing requirements for the 3-2 combination: 3.0 metres between the two single axles of the trailer when registered at the higher primary highway weights, and 2.4 metres between these same two axles when registered at the lower secondary highway weights. Finally, New

Brunswick requires larger spacings on seven-axle B-trains and 3-4 combinations than do Newfoundland and Nova Scotia (#13 in Table 18.)

- **Quebec:** Maximum GVW is the lesser of the sum of the allowable axle loads or the weight specified in a schedule of 60 truck or truck- combination types. The schedule contains a "formula" for determining maximum loads that incorporates a weight penalty as axle spacing decreases. For example, the standard five-axle tractor-semitrailer is permitted a maximum GVW of 48,500 kg; the critical spacing is the distance between the third and fourth axle (the last axle on the tractor and the first axle on the semitrailer). Once this spacing is less than 3.0 metres, 450 kg per 0.3 metre is deducted from the allowable weight.

There are several other points to note about Quebec. First, the allowed GVWs shown in the schedule are always the sum of the maximum axle weights, given the particular axle types, spreads, and spacings shown. Second, the maximum allowed GVW is 57,500 kg. Third, the critical axle spacing that is treated as a variable in this schedule only applies to combinations with four or more axles; there are no spacing requirements for a three-axle tractor-semitrailer or a two-axle truck with a single-axle pup. Fourth, for all tractor-semitrailer combinations shown (other than three-axle), the critical spacing is the same as what Ontario defines as the "inter-vehicle-unit-distance" -- the distance between the centre of the last axle on the tractor and the first axle on the semi- trailer. Fifth, for truck-plus-trailer combinations and for A- and B-trains, the critical spacing requirement is the distance between the first drive axle and the very last axle in the combination (the only exception being in the case of tandem-front-axle trucks). This method of specifying axle spacing requirements, "first-drive-to-last-axle", is unique to Quebec. Sixth, the load penalty is 450 kg per 0.3 metres for most combinations, rising to 900 kg per 0.3 metres for most combinations using triple axles, tri-axles, and other large axle combinations.

There may be a slight bias for A-trains (over B-trains) in these regulations: considering three-axle tractors only, the regulations permit a six-axle A-train with a spacing between the second and last axle of 14 metres to reach the maximum GVW of 57,500 kg, whereas a B-train is required to have seven axles and a spacing between the second and last axle of 15.5 metres. In a situation where dense freight was being hauled, there might be some economic/operational advantages for opting for an A-train configuration.

There are no seasonal or road-class aspects to Quebec's GVW regulations (other than those affecting axle loads).

In Table 20, the method used to determine GVW in Quebec is shown for three combination types. The axle loads shown are the maximum allowed, not the actual weights. In the first example (3-S2), the allowable GVW decreases from 48,500 to 48,050 kg as the spacing from the third to the fourth axle decrease to 2.7 metres. There is no axle- spacing requirement for the tractor.

In the second example shown (3-S3), the allowable GVW decreases from 55,500 to 54,600 kg as the spacing from the third to the fourth axle decreases to

3.9 metres. Such 3-S3s are allowed higher GVWs if triple axles with larger outer spreads are used. In the third example shown (A-trains), tandems with only 1.5 metres are shown as the sum of the allowable axle weights far exceeds the maximum 57,500 kg GVW limit. In this case, the allowable GVW decreases from 57,500 to 57,050 kg as the spacing between the second and seventh axle decreases to 15.2 metres. To re-emphasize a point, in the A-train example, there is no spacing requirement for the tractor or the pup trailer. This is different than the spacing requirements in other jurisdictions. The load on the pup trailer is affected by the axle-load regulations; however, these only require the two axles to be spaced at least 1.0 metres apart for the loads shown.

maximum GVW (kg)	Spreads, Spacing, Axle-Loads (1,000 kg)					
* 5-axle tractor semitrailer		tractor			semitrailer	
		o	o--o		o--o	
48,500	spreads		2.4		2.4	
	spacing		|	-3.0-	|	
	axle loads	8.5	20		20	
48,050	spreads		2.4		2.4	
	spacing		|	-2.7-	|	
	axle loads	8.5	20		20	
* 6-axle tractor semitrailer		tractor			semitrailer	
		o	o--o		o--o--o	
55,500	spreads		2.4		2.4	
	spacing		|	-4.2-	|	
	axle loads	8.5	20		27	
54,500	spreads		2.4		4.2	
	spacing		|	-3.9-	|	
	axle loads	8.5	20		27	
* 7-axle A-train		tractor	semitrailer		trailer	
		o	o--o	o--o	o	o
57,500	spreads		1.5	1.5		
	spacing		|	----15.5----		|	
	axle loads	8.5	18	18	10	10
57,050	spreads		1.5	1.5		
	spacing		|	----15.2----		|	
	axle loads	8.5	18	18	10	10

Table 20 Quebec: Method Used to Determine GVW

- **Ontario:** Maximum GVWs are the lesser of three calculations: the sum of allowable axle loads; the sum of the front axle load plus the allowed load for "axle groups"; or the weight as determined from a series of 29 tables. The first of these calculations has been described in preceding sections. The second calculation is similar, but involves one variable not yet described: the spacing of axles in an axle group.

Axle groups are defined as two, three, or four-axle. In all cases, the axles have to be entirely within one vehicle, cannot include the front axle of a motor vehicle, and are different than tandem axles (in the case of a two-axle group) or triple axles (in the case of a three- axle group). The differences between tandems and triples versus two and three-axle groups is that the former equalize loads. Further, a two-axle group cannot include axles included within a three-axle group; and, a three-axle group cannot include axles included within a four-axle group. A two-axle group (other than the exclusions just noted) is any two axles with a spacing of less than 2 metres; the allowed loads are slightly less than those allowed for tandem axles with comparable spreads. A three-axle group is any three axles where both inner spacings are 2.5 metres or less; the allowed loads are slightly less than those permitted for triple axles with comparable spreads. A four-axle group is any four axles with all inner spacings of 2.5 metres or less; the allowed maximum load is 38,000 kg at an outer spacing of 7.5 metres or more -- beyond such a spacing, one or more of the axles would become "independent."

The third calculation, involving 29 tables, gives consideration to four variables: front-axle load; "base length" (the distance between the first and last axle in a vehicle or combination of vehicles); number of axles; and, the "inter or intra-vehicle-unit distance". The "inter- vehicle-unit distance" is the distance between the last axle of one vehicle and the first axle of the next vehicle in a vehicle combination. In considering three-vehicle combinations, the determining inter-vehicle- unit distance is the shorter of the two possibilities. An "intra- vehicle-unit distance" only occurs in a five or six-axle truck: it is the greater of (going from front to back) the distance between the second and third axle, or the third and fourth axle.

The only point to note about seasonal or road-class aspects of these regulations (other than the effect that seasonal or road-class axle-load regulations might have) is that in the winter the GVW for trucks hauling raw forest products is increased by 10%.

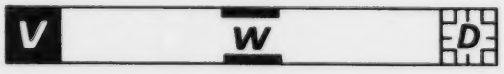
Examples of the method used to determine allowable GVWs are shown in Table 21. The first 3-S2 shows the maximum GVW for such a combination. To register at 47,200 kg this combination has to have: 9,000 kg on the front axle; 1.8 metre or greater tandem spreads; an inter-vehicle-unit-distance (IVUD) of 3.6 metres or more; and, a base length (BL) of 11.75 metres or more. A more realistic case is shown with the second 3-S2: here the sum of the allowable axle loads equals 41,100 kg, and it is the tables (Table 13 of the Ontario regulations) which limits the GVW to 39,400 kg. While the spacing of axles on the tractor is not specifically regulated, the IVUD, BL, and spread requirements effectively control this.

The six-axle combination shown has a total axle load of 51,270 kg, and an allowed GVW from the tables (Table 20 of the regulations) of 52,500 kg. However,

as the three axles on the semitrailer constitute a three-axle group (the spacing between the fourth and fifth axle is less than 2.51 m), the effective constraint on the allowable GVW becomes the existence of this axle group. The allowable load on this axle group is 26,000 kg (hence, 5,370 + 16,800 + 26,000 = 48,170).

maximum GVW (kg)	Spreads, Spacing, Axle-Loads (1,000 kg)				
*	5-axle tractor semitrailer	tractor			semitrailer
		o	o--o		o--o
47.200	spreads		1.8		1.8
	spacing (IVUD)			- 3.6 + -	
	spacing (BL)		---- 11.75 + ----		
	axle loads	9	19.1		19.1
39,400	spreads		1.2		1.82
	spacing (IVUD)			- 3.81 -	
	spacing (BL)		---- 9.13 ----		
	spacing (other)	- 2.3 -			
	axle loads	5.2	16.8		19.1
*	6-axle tractor semitrailer	tractor			semitrailer
		o	o--o	o	o--o
48,170	spreads		1.29		1.82
	spacing (IVUD)			- 5.68 -	
	spacing (BL)		---- 14.93 ----		
	spacing (other)	- 3.73 -		2.41	
	axle loads	5.37	16.8	10	19.1
*	7-axle A-train	tractor	semitrailer		trailer
		o	o--o	o--o	o	o
57,500	spreads		1.5	1.5		
	IVUD		- 5.0 -	3.0		
	BL		---- 18.6 ----			
	other	- 3.6 -			- 4.0 -	
	axle loads	5	17.9	17.9	10	10
*	7-axle B-train	tractor	semitrailer		semitrailer	
		o	o--o	o--o	o--o	
58,700	spreads		1.5	1.5	1.5	
	IVUD		- 5.3 -		- 5.2 -	
	BL		---- 18.6 ----			
	other	- 3.6 -				
	axle loads	5	17.9	17.9	17.9	

Table 21 Ontario: Method Used to Determine GVW



With the A-train, the IVUD is 3.0 metres (ie, the shorter of the two axle spacings between axles of different vehicles). The sum of the axle loads is 60,800 kg, and the allowed GVW from the tables (Table 25) is 57,500 kg (there are no axle groups, so the third calculation does not have to be made).

In the final example shown, a 3-S2-S2 with similar dimensions to the A-train (tractor wheelbase, base length, and axle spreads are identical) is allowed 1,300 kg more in GVW. The reason for this and, the reason why Ontario's regulations may encourage B-trains (slightly) over A-trains, is that it is easier to have the larger IVUDs on B-trains than on A-trains.

- **Manitoba:** The GVW limits are prescribed for five different road classes: the only two of importance are the 56,500 kg limit for primary highways and the 47,630 kg limit for secondary highways. Allowable GVWs are determined by summing the allowable axle loads up to the maximum GVW permitted the particular road classes. In the winter, the effect of the 10% axle-load increase (excluding front-steering axles) is to increase allowable GVWs, except that the various road-class maximum limits still cannot be exceeded. The individual axle loads are as described previously **as long as** the inner spacings are greater or equal to the:

- front-steering axle to first drive axle	3.0 m
- single axle to single axle	3.5 m
- single axle to an axle group	3.5 m
- axle group to axle group, except end-dump-bulk trailers	5.0 m
- axle group to axle group on end-dump-bulk trailers	4.0 m

If inner spacings are less than these minimums, then the combined load allowed on adjacent axles (axle groups) is reduced by 330 kg for every 0.1 metres or part thereof.

Other considerations in Manitoba are:

- a trailer can have no more that two axles, or two axle groups, or one axle and one axle group;
- a semitrailer can have no more than one axle or one axle group;
- the distance between the front of a trailer and the rear of its towing vehicle must be less than or equal to 4.0 metres.

The first two of these considerations effectively prohibit belly axles; and, in combination with the definition of axle group, prohibit the use of triple axles with outer spreads greater than 3.0 metres.

Examples of the method used to determine allowable GVWs in Manitoba are shown in Table 22. The first, a 3-S2, shows the maximum GVW for such a combination -- given that the front-axle load is held to 5,500 kg. The minimum spacing requirements (3 and 5 m) have been met, and the axle spreads could be anywhere from 1 to 2 metres (but are shown as 1.5 m).

maximum GVW (kg)	Spreads, Spacing, Axle-Loads (1,000 kg)									
*	5-axle tractor semitrailer		tractor						semitrailer	
			o		o--o				o--o	
37,500	spreads				1.5				1.5	
	spacing		| - 3.0 -		| |		- 5.0 -		|	
	axle loads		5.5		16				16	
36,340	spreads				1.5				1.5	
	spacing		| - 3.0 -		| |		- 4.8 -		|	
	axle loads		5		16				16	
*	7-axle A-train	tractor		semitrailer			trailer			
		o		o--o		o--o		o		o
55,200	spreads			1.5		1.5				
	spacing	| - 3.0 -		| | - 5.0 -		| |	3.5	| - 3.5 -		|
	axle loads	5		16		16		9.1		9.1
*	7-axle B-train	tractor		semitrailer			semitrailer			
		o		o--o		o--o		o--o		
58,700	spreads			1.5		1.5		1.5		
	spacing	| - 3.0 -		| | - 5.0 -		| | - 5.0 -		|		
	axle loads	5		16		16		16		

Table 22 Manitoba: Method Used to Determine GVW

The sum of allowed axle loads for the second tractor-semitrailer is 37,000 kg; however, the GVW is limited to 36,340 kg because of the axle spacings. The spacing between the third and fourth axle is 0.2 metres less than 5.0 metres and, as a result, 660 kg is deducted from the allowed GVW.

The third and fourth examples show seven-axle A- and B-trains with all minimum spacing requirements met. With the same number of axles, the A-train is allowed a higher GVW than the B-train. Manitoba's regulations encourage the use of A-trains. That is, it is not possible for a B-train in Manitoba to register at the maximum GVW of 56,500 kg: the maximum for a B-train is 53.5 tonnes (5.5 + 16 + 16 + 16). An A-train, on the other hand, can be registered at 56,500 kg: in Table 22, if the pup trailer had a single plus a tandem axle, the sum of the allowed axle loads would be 62,100 kg -- well in excess of the maximum 56,500 kg limit. This relative advantage of using A-trains disappears in the winter. That is, the B-train shown in Table 22 is allowed 17,600 kg on each tandem axle in the winter: the sum of the allowed axle loads is then 57,800 kg.

- **Saskatchewan:** GVW limits are prescribed for three road classes, three truck or combinations types, and two seasons. Only two of the road classes are important for here:

	Primary (kg)	Secondary (kg)
standard (non-winter)		
4-axle truck	27,000	25,500
tractor-semitrailer	37,500	34,500
combinations	53,500	49,000
winter		
4-axle truck	28,600	28,600
tractor-semitrailer	40,700	40,700
combinations	53,500	53,500

The allowable GVW is determined by summing allowable axle loads to a total not exceeding the truck/road/season maximums. The allowed axle loads are permitted as long as the inner spacings are greater or equal to the following:

- single axle to single axle, including front-steering axle 3.5 m
- single axle to tandem axle 3.5 m
- tandem axle to tandem axle, except end-dump semitrailers 5.0 m
- tandem axle to tandem axle, on end-dump semitrailers 3.35 m

If the spacings are less than these minimums, the combined weight possible on adjacent axles (axle groups) is reduced by 1,400 kg for every 0.3 metres or part thereof.

Some examples of the method used to determine allowable GVWs are shown in Table 23. The first example shows the maximum possible GVW for a 3-S2. This is similar to the situation in Manitoba, except the axle spacing on the tractor is slightly longer. The second tractor-semi- trailer shows the effect of reducing the axle spacings below the minimums described previously (1,400 kg is deducted from the allowed GVW as the spacing between the third and fourth axle is 0.3 metres less than 5.0 m).

The third and fourth examples show seven-axle A- and B-trains with all minimum spacing requirements met. While the sum of the allowed axle loads for the A-train is 55,700 kg, the GVW is held to the 53,500 kg limit for primary highways. This is a deliberate policy on the part of Saskatchewan in that the regulations have been written so as to be neutral with respect to the use of A or B-trains; they both can register at the maximum primary highway limit.

There is, however, a superficially illogical aspect to these regulations. To this effect, the GVW limits on secondary highways are increased from 49,000 to 53,500 kg in the winter. Presumably, the technical basis for the 49,000 kg secondary highway limit is related to bridges. If, however, bridges can handle 53,500 kg in the winter, they can also handle 53,500 kg in the summer. The explanation for this

maximum GVW (kg)	Spreads, Spacing, Axle-Loads (1,000 kg)
* 5-axle tractor semitrailer	tractor / semitrailer
	o o--o o--o
37,500	spreads: 1.5 1.5
	spacing: | -3.5- | | -5.0- |
	axle loads: 5.5 16 16
36,340	spreads: 1.5 1.5
	spacing: | -3.5- | | -4.7- |
	axle loads: 5.5 16 16
* 7-axle A-train	tractor / semitrailer / semitrailer / trailer
	o o--o o--o o o
53,500	spreads: 1.5 1.5
	spacing: | -3.5- | | -5.0- | 3.5 | -3.5- |
	axle loads: 5.5 16 16 9.1 9.1
* 7-axle B-train	tractor / semitrailer / semitrailer
	o o--o o--o o--o
53,500	spreads: 1.5 1.5 1.5
	spacing: | -3.5- | | -5.0- | | -5.0- |
	axle loads: 5.5 16 16 16

Table 23 Saskatchewan: Method Used to Determine GVW

apparently illogical aspect to the regulations is Saskatchewan's desire to discourage the use of A-trains. That is, given the secondary highway axle-load limits, the only combinations which would be permitted to register up to 53,500 kg on secondary highways would be A-trains (ie, applying the secondary highway axle-load limits to an eight-axle A-train, with a three-axle pup, results in allowable axle loads of 5,500 + 14,500 + 14,500 + 8,200 + 14,500 = 57,200; the sum of allowed axle loads on a B-train is only 49,000 kg).

- **Alberta:** A single maximum GVW of 53,500 kg is prescribed (ie, not conditioned by vehicle type, road class, season).* The allowable GVW for any particular truck or combination type is calculated on the basis of the sum of the allowable axle loads, not exceeding this 53,500 kg limit. In the winter, the effect of the 10% premium on axle loads (excluding front-steering axles) is to increase allowable GVWs, again, not to exceed the 53,500 kg limit. The loads allowed an axles are permitted as long as the inner spacings are greater than or equal to the following:

---

* *Alberta is beginning to special permit 8-axle A-trains at 62.5 tonnes.*

- single-front-steering axle (less than 14 inch tires) to first drive axle 3.0 m
- single-front-steering axle (14 inch or larger tires) to first drive axle 3.5 m
- tandem-front-steering axle to first drive axle 5.0 m
- single axle to single or tandem axle 3.5 m
- tandem axle to tandem axle 5.0 m

If the spacings are less than these (except between front steering axles and drive axles, where special permits are required), the combined weight permitted on adjacent axles (axle groups) is reduced by 1,400 kg for every 0.3 metres or part thereof, subject to the following:

- the combined allowable weight on two tandem axles is not decreased below the combined allowable weight permitted on a tandem and a single, where the spacing is measured between the inside of one tandem and the outside of the adjacent tandem.

- the spacing between a tandem and a single axle (or the outside axle of an adjacent tandem axle) cannot be less than 2.3 metres.

Other critical consideration in Alberta are:

- a semitrailer can have no more than one single axle, one tandem axle, or one triple axle (called a "tandem" in Alberta);

- a stiff-poled pup trailer can have either one tandem or one triple ("tandem") axle;

maximum GVW (kg)	Spreads, Spacing, Axle-Loads (1,000 kg)						
*	5-axle tractor semitrailer		tractor				semitrailer
			o	o--o			o--o
40,900	spreads			2.4			2.4
	spacing		- 3.5 -	| |	- 5.0 -		|
	axle loads		7.3	16.8			16.8
*	7-axle A-train	tractor	semitrailer			trailer	
		o	o--o	o--o	o		o
53,500	spreads		1.5	1.5			
	spacing	| - 3.0 -	| | - 5.0 -	| |	3.5	| - 3.5 -	|
	axle loads	5	16	16		9.1	9.1

Table 24 Alberta: Method Used to Determine GVW

- a trailer must have, but can have no more than two axles (eg, two singles, one single and one triple, two tandems, etc.)

These rules prohibit the use of belly axles in Alberta.

Two examples of the method used to determine allowable GVWs are shown in Table 24. No 3-S2 with less than the minimum spacing requirements is shown as the essential features of the regulations are the same as in Saskatchewan. Also, a B-train is not shown as, again, the essential features are the same as in Saskatchewan (ie, the regulations are neutral with respect to the use of A or B-trains, and unlike the situation in Saskatchewan, there is no secondary road issue).

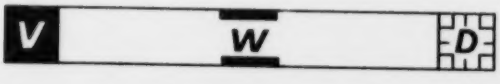
- British Columbia: A single GVW limit of 63,500 kg is prescribed, except in the case of three-vehicle combinations towed by a truck where the limit is 57,000 kg. Allowable GVWs depend on the allowable axle loads, the allowable loads on axle groups, and a number of special rules.

The axle group spacing requirements, with attendant load reductions are specified differently in British Columbia than in the other western provinces. For any group of two or more axles (within a vehicle or a vehicle combination), a maximum load is specified, where the critical spacing is the **outer spacing** (first to last axle). The allowed loads on these axle groups vary between 16,500 kg for a spacing of less than 1.5 metres to 34,000 kg for a spacing of 8.0 metres or more: the progression in allowed loads is roughly 1,000 kg for every 0.3 to 0.4 metres. The result is that single plus single, single plus tandem, and tandem plus tandem axles are not permitted the loads described in Sections 3.5.3 and 3.5.4 until the following minimum outer spacings are reached:

- single axle to single axle 2.3 m
- single axle to tandem axle 5.3 m
- tandem axle to tandem axle 8.0 m

Special rules affecting the determination of allowable GVWs are:

- the steering axle in a three-vehicle combination is limited to 6,000 kg.
- at least 20% of the total GVW must be on the drive axle(s).
- the GVW on a three-vehicle combination is limited to 57,000 kg unless: the towing unit is a tractor, and the kingpin on the first semitrailer is positioned at, or forward of, a point midway between the centres of the two rear most axles of the tractor.
- the GVW is limited to 38,000 kg unless: the towing vehicle has at least two drive axles; and, the ratio of GVW to gross horsepower is less than or equal to 150 kg/hp.
- if the vehicle is carrying logs or poles, the GVW is as calculated plus 1,500 kg (March 2 - November 30) or plus 2,500 kg (December 1 - March 1) to a limit of 63,500.



maximum GVW (kg)	Spreads, Spacing, Axle-Loads (1,000 kg)					
*	5-axle tractor semitrailer	tractor				semitrailer
		o	o--o			o--o
43,100	spreads		1.5			1.5
	spacing	| -5.3- |				
	spacing		|	----8.0----		|
	axle loads	9.1	17			17
41,100	spreads		1.5			1.5
	spacing	| -5.3- |				
	spacing		|	----7.5----		|
	axle loads	9.1	17			17
*	6-axle tractor semitrailer	tractor				semitrailer
		o	o--o	o		o--o
48,100	spreads		1.5			1.5
	spacing	| -5.3- |		|	-5.3-	|
	spacing		| -5.3-	|		
	axle loads	5	17	9.1		17
*	7-axle A-train	tractor	semitrailer			trailer
		o	o--o	o--o	o	o
56,000	spreads		1.5	1.5		
	spacing	| -5.3- |		| -5.3-	|	
	spacing		| ---8.0--- |		| -2.3-	|
				|	----7.6----		|
	axle loads	6	17	17	9.1	9.1
*	7-axle B-train	tractor	semitrailer		semitrailer	
		o	o--o	o--o	o--o	
57,000	spreads		1.5	1.5	1.5	
	spacing	| -5.3- |		|----8.0----	|	
	spacing		| ----8.0----	|		
	axle loads	6	17	17	17	

Table 25 British Columbia: Method Used to Determine GVW

Other critical considerations in British Columbia are:

- for every two consecutive axles, one of the axles must rotate or articulate in the manner of a steering axle. Tandem axle groups are excluded from this provision.

- a semitrailer with more than two axles is limited to a length of 14 metres; this is designed to prohibit the use of self-steering belly axles on the new 48-foot semitrailers (until the results of the RTAC/CCMTA study are available).

Some examples of the method used to determine allowable GVWs are shown in Table 25. In the first example, the maximum GVW for a 3-S2 is shown, even though the front-axle load is unrealistic. Note that the spacing requirements are specified as outer spacings. The second 3-S2 is included to show the effect of having less than the minimum spacings required for axle loads to be "independent". As the spacing from the second to fifth axle is only 7.5 metres, the allowed load on the two tandems is 32,000 kg (versus 34,000 kg when they are independent).

The third example (3-S3) is included to show the "overlapping" nature of the axle-spacing requirements. The spacings have been set such that the allowed GVW equals the sum of the "independent" axle loads. Also, the fourth axle shown has to be a self-steering axle.

The fourth and fifth examples (A- and B-trains) also show the over- lapping nature of the spacing requirements. In the case of the A-train, the spacing between axle #4 and #7 is only 7.6 metres -- giving these four axles a combined allowable load of 33,000 kg (versus the 35,200 kg shown). For these trains, front-axle loads are limited to 6,000 kg.

The regulations in British Columbia create a slight potential advantage for A-trains over B-trains. That is, for the same number of axles an A-train is allowed a higher GVW than a B-train. For example, consider a 3-S2-S2 registered at 57 tonnes -- 6,000 + 17,000 + 17,000 + 17,000 -- with a 3-S2-2 registered at 58.2 tonnes -- 6,000 + 17,000 + 17,000 + 9,100 + 9,100. Given a higher tare weight for most B-trains, this apparent difference of 1.2 tonnes may actually be as much as two to three tonnes difference in "free" payload for the A-train.

- **Yukon:** The calculation of maximum GVWs is the same as in Ontario (although there are differences in the length regulations).

- **Northwest Territories:** A single GVW limit of 54,500 kg has been established by a mechanism of not issuing registration certificates at weight levels higher than this. The actual allowable GVW for a truck is calculated from the tire-load limit of 80 kg/cm, to a maximum of 25.4 cm (2,032 kg per 10 inch tire). Somewhat higher loads are permitted on steering-axle tires (see Section 3.4). Winter season loads are increased by 10% for both axles and GVWs (and is implied for tire loads).

To achieve the maximum allowable axle loads, axles (including axle groups) must have a spacing of 14 feet. If they are not so spaced, the vehicle is prohibited from operating except that in practice the 14-foot requirement is not enforced (i) between the steering and the first drive axles, and (ii) where the spacing at an A-train connection is less than 14 feet, the combined weight on the group of axles is limited to either the tandem-weight allowance (where one of the axles is a tandem) or the single-axle-weight allowance (where both are singles).

- CHANGES SINCE 1970: Considering just maximum GVWs (and ignoring other considerations such as methods, road class, seasonal aspects, spacing requirements), changes in maximum GVWs are shown in Table 26.

	maximum GVW (kg)		change	
	1970	1985	kg	%
Nfld	33,566	52,500	+ 18,934	56.4
PEI	33,566	53,500	+ 19,934	59.4
NS	33,566	50,000	+ 16,434	49.0
NB	33,566	56,500	+ 22,934	68.3
Que	33,566	57,500	+ 23,934	71.3
Ont	52,617	63,500	+ 10,883	20.7
Man	33,566	56,500	+ 22,934	68.3
Sask	33,566	53,500	+ 19,934	59.4
Alta	32,659	53,500	+ 20,841	63.8
BC	34,473	63,500	+ 29,027	84.2
Yukon	33,248	63,500	+ 30,052	90.4
NWT	?	54,500		

Table 26 Changes in Maximum GVW: 1970 - 1985

	maximum gross vehicle weight (number of axles):			
	truck	truck + trailer	tractor + semitrailer	train (A or B)
Nfld	34,000 (4)	52,500 (7)	48,500 (6)	52,500 (7)(B)
PEI	26,082 (3)	sp. permit	53,297 (6)	sp. permit
NS	34,000 (4)	50,000 (7)	50,000 (6)	50,000 (7)(B)
NB	34,000 (4)	56,500 (7)	53,000 (6)	56,500 (7)(B)
Que	37,500 (4)	57,500 (6)	57,500 (6)	57,500 (7)(B) 57,500 (6)(A)
Ont	47,500 (5)	63,500 (8)	63,500 (8)	63,500 (8)
Man	32,000 (4)	55,300 (7)	37,500 (5)	56,500 (8)(A) 55,300 (7,8) (B)
Sask	27,000 (4)	53,500 (7)	37,500 (5)	53,500 (7)
Alta	30,400 (4)	53,500 (7)	40,900 (5)	53,500 (7)
BC	34,000 (4)	60,100 (7)	52,200 (6)	63,500 (8)
Yukon	47,500 (5)	63,500 (8)	63,500 (8)	sp. permit
NWT	29,256 (4)	54,500 (7)	39,012 (5)	54,500 (7)

- Based on primary highways, summer-time, no special permits, maximum front-axle loads (unrealistic in some cases), and no tolerances.
- Tractor-semitrailers with jeeps and/or extenders are not considered

Table 27 Maximum GVW by Truck Type/Axle Number

- REGULATIONS IN BORDERING STATES: As shown in Table 17, allowable GVWs in bordering states are lower than in Canada, with the notable exception of Michigan. (The information shown in the Table is taken from a February 1985 publication from the American Trucking Association; other sources suggest that the GVW limits are higher in Alaska (117,000 lbs) and Michigan (154,000 lbs).)

- COMMENT: To summarize the differences in allowable GVWs, a number of comparisons are shown in Table 27. The figures for Prince Edward Island have been converted from Imperial measures; in Ontario the largest straight truck shown is five-axle, even though the regulations refer to six-axles; also in Ontario, the tables in the regulations show that the maximum GVW of 63,500 kg can be reached with seven-axle combinations, but for this to be possible front-axles with dual tires would have to be used (this is not feasible); and finally, the front-axle loads in Manitoba are assumed to be 7,300 kg in the case of the truck-plus-trailer, and 5,500 in the case of the other combinations (whatever the regulations say, these are understood to be the de facto maximums).

4. Special Topics

4.1 SEASONAL ASPECTS OF REGULATIONS: SUMMARY

The seasonal aspects of the regulations have been described in previous sections. They are summarized in Table 28.

- **Newfoundland and the Yukon:** There are no seasonal aspects.

- **Prince Edward Island:** Spring-load reductions for permitted axle loads are applied to secondary (non-designated) highways as follows: 10,000 lbs for single (including steering) axles, and 12,000 lbs for all other axles. In practice, these spring load limits are rounded to 4,500 and 5,500 [?] kg. The effect of these lower axle loads is that the maximum GVW of any of the eight truck or combination types included in the GVW schedules is reduced to 32,000 kg. Some commodities (potatoes, livestock, feed, fish, and milk) are exempted from these axle-load reductions. On the primary (designated) roads, the only seasonal aspect of the regulations is that the ordinary axle-tolerances are eliminated.

- **Nova Scotia:** Spring axle-weight reductions apply to all secondary roads. The allowable loads are 6,500 kg on steering and single axles and 12,000 kg on tandem and triple axles.

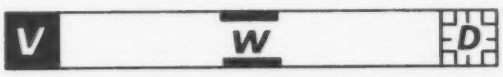
- **New Brunswick:** In the spring, the lesser of the sum of the allowed tire loads, or the axle rating is reduced by percent reductions (10% or 20%) depending on the results of road testing. Although the authority to reduced either tire or axle loadings exists for all roads in the province, as a matter of practice, reductions on primary roads are not introduced.

- **Quebec:** During periods of "thaw or rain" all axle loads on all roads are reduced according to a fixed schedule. It is unlikely these reductions are enforced in all cases: in particular, on major highways during periods of rain. Some examples (from the 25 axle types):

single-front-steering	7,500	versus	8,500
single	8,000	versus	10,000
tandem (2.4 m)	16,000	versus	20,000
triple (4.8 m)	24,500	versus	30,000

However, maximum GVWs are not reduced (Regulation #25). That is, the maximum GVW is still the sum of the "non-thaw" axle loads. Further, dump trucks (etc.) appear to be excluded from these "rain/thaw" axle-load reductions (Regulation #24).

- **Ontario:** In the winter "freeze-up", vehicles hauling loads of raw forest products are permitted 110% of the normal axle and GVW loads. In spring ("reduced load period"), on designated highways (typically rural



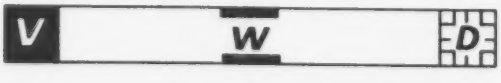
secondary roads) allowable axle weights are reduced to 5,000 kg (eg, a tandem is permitted 10,000 kg); there are some exceptions to this (eg, two-axle fuel or livestock trucks where 7,500 kg is allowed).

- **Manitoba:** In the winter (Dec. 1 - Feb. 28) allowable axle loads (excluding steering) are increased by 10% -- there is some dispute as to whether this applies to primary highways only or all highways. Although the maximum GVWs are not increased, the effect is nevertheless to allow some trucks to operate at higher weights (for example, a 3-S2 which because of the maximum axle loads operates under the maximum GVW during the summer). In the spring, allowable tire loads may be reduced on secondary roads; again there is some dispute as to whether the reduction is 6 kg/mm or 4.5 kg/mm and whether or not these reductions apply to all highways or just secondary highways. Also in the spring, no overloads are permitted. Finally, there is conflicting opinions as to whether or not there are any axle-load reductions in Manitoba in the spring.

	Tire-Load		Axle-Load		GVW	
road class	primary	secondary	primary	secondary	primary	secondary
Nfld.	--	--	--	--	--	--
P.E.I.	--	--	--	S(c)	--	--
N.S	--	--	--	S	--	--
N.B.	--	S(r,p)	--	S(r,p)		
Que.	--	--	S	S(v)	--	--
Ont.	--	--	W(c)	S,W(c)	W(c)	W(c)
Man.	S (?)	S(r)	W	W (?)	--	--
Sask.	W	W,S(r)	W	W	W	W
Alta.	--	--	W	W,S(r,p)	--	--
B.C.	--	--	--	--	W(v)	W(v)
Yukon						
N.W.T.	W,S(r,p)	W,S(r,p)	W,S(r,p)	W,S(r,p)	W,S(r,p)	W,S(r,p)
LEGEND		general	some commod-ities	some vehicules	some roads	potential spring loads
spring reductions		S	S(c)	S(v)	S(r)	S(p)
winter premiums		W	W(c)	W(v)	W(r)	

Table 28 Summary of Seasonal Aspects

- **Saskatchewan:** In the winter (December 1 to February 28) allowable axle loads are increased by 10% (except steering) over the allowable primary highway loads. In other words, all roads (not just primary) are allowed to operate at the higher axle weights in the winter. The effect is that on secondary roads the allowable single and tandem axle loads increase by



over 20% in the winter. Further, allowable GVWs are also increased in the winter (except that the primary maximum 53,500 kg is not increased). (The next section on road-class aspects provides the summer/winter, axle/GVW information.)

Finally, tire loads are also increased in the winter (from 9 to 10 kg/mm); and in the spring, there are some tire-load reductions on oil-treatment roads (400 lbs/inch on steering axles and 350 lbs/inch on carrying axles).

- **Alberta**: In the winter (dates vary from year to year and region to region), 110% is allowed on axle weights. (There is some uncertainty as to whether or not this applies to steering axles.) In the spring, axle loads may be reduced by a certain percentage (typically 10% or 20%) on some roads depending on road tests. In Table 28, the spring reductions are shown as both "r" (ie, only some secondary roads) and "p" (ie, potential given test results).

- **British Columbia**: Logging trucks are allowed an additional 1,000 kg in the winter, not exceeding the 63,500 kg limit (ie, in the summer, logging trucks are allowed an additional 1,500 kg increasing to 2,500 kg in the winter over the usual "sum-of-axle-load" method of determining GVW). Officials in British Columbia advise that because of the rapidly changing weather conditions, it is not feasible to implement seasonal load reductions or increases on most highways in the province. (Nevertheless, other officials advise that there may be spring axle-load reductions.)

- **Northwest Territories**: In the winter, allowable axle loads and GVWs are increased by 10% on all roads. In the spring, there may be percent reductions, depending on road tests, on paved roads. As both axle and GVW limits are effectively the sum of allowable tire loads, these winter premiums and spring (potential) reductions amount to changes in the tire loads (accordingly, in Table 28, these seasonal aspects are noted in ali columns).

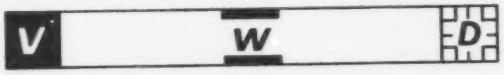
4.2 ROAD CLASS ASPECTS OF REGULATIONS: SUMMARY

The following notes summarize the road-class aspects of weight and dimension regulations:

- **Newfoundland, Alberta, British Columbia, the Yukon, and the Northwest Territories**: There are no road classes in these jurisdictions (at least in terms of weight and dimension regulations).

- **Prince Edward Island**: For weight and dimension regulations, the only road classification is in connection with spring axle-weight reductions (see previous section).

- **Nova Scotia**: for spring ban, roads are divided into essentially all-weather versus secondary. For axle and GVW purposes, roads are divided into "all" versus "Schedule C". The higher weights allowed are these "C" roads are:



18,000 kg for tandems (1.8 m spread only, trailers or semitrailers only) versus 17,000 kg on other roads; a range of loads on triples (20,500 to 27,000 kg depending on spread) versus 17,000 on other roads; higher GVWs as allowed by these higher axle weights; and, for one particular vehicle type (seven-axle B-train or seven-axle truck + trailer) a maximum GVW of 50,000 versus 38,500 on other roads (note: this 50,000 is independent of the higher axle weights allowed on "c" roads)

- **New Brunswick:** Roads are not classified as per application of spring weight reductions (however, as a matter of practice the spring weight loads are never applied to the primary highways). In terms of other divisions, all roads are in three groups: GVW less than 38,500; GVW less than 50,000; and GVW less than 56,500. Roads can be up-graded and, once up-graded, are never down-graded. Axle loads do not vary by class of road.

- **Quebec:** The only road-class aspect to Quebec's regulations are the higher axle and gross loads allowed on roads leading into James Bay.

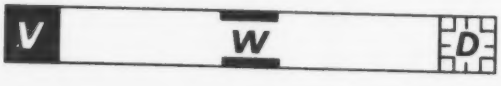
- **Ontario:** All roads under provincial authority are divided into Class "A" and "B". Regulation 458 designates the following as Class "A": all King's highways (ie, all provincial highways); all highways within a city, town, or village except those where heavy traffic is prohibited; and, all hard-surfaced county and township highways (ie, rural roads), except those designated by a county or township by-law. In effect, then, most hard surfaced roads in Ontario are Class "A" (and, there is some suspicion that most gravel roads are treated as Class "A" as far as weight and dimension regulations are concerned). The major difference between the two classes of roads is that axle-load regulations on class "B" are very simple: 8,200 kg per axle (or 5,500 kg if spacing is less than 2.4 m).

- **Manitoba:** Manitoba's roads are divided into five classes, with different axle and gross weight limits applying to each class:

	highway class load limits (kg)				
	A1	A	B1	B	C
steering axle	5,500	5,500	5,500	5,500	5,500
single axle	9,100	8,200	8,200	8,200	8,200
axle group	16,000	14,500	14,500	14,500	8,200
GVW	56,500	33,600	47,630	20,000	12,700

In considering most trucks in Manitoba, the only two of these class that are important are "A1" (basically a "primary" highway as that term is used here), and "B1" (most rural secondary highways).

- **Saskatchewan:** Saskatchewan's roads are divided into three classes (primary, secondary, municipal) for the purpose of axle, gross, and



seasonal-load regulations. These are summarized in the following (where "s" and "w" represent the two seasons):

		primary (kg)	secondary (kg)	municipal (kg)
axle loads				
steering	s	5,500	5,500	5,500
	w	5,500	5,500	5,500
single	s	9,100	8,200	8,200
	w	10,010	10,010	10,010
axle group	s	16,000	14,500	14,500
	w	17,600	17,600	17,600
GVW				
4-axle truck:	s	27,000	25,500	25,500
	w	28,600	28,600	28,600
tractor-semi	s	37,500	34,500	34,500
	w	40,700	40,700	40,700
other comb.	s	53,500	49,000	34,500
	w	53,500	53,500	40,700

4.3 TOLERANCES

- **Newfoundland:** Tolerances of 500 kg per axle are permitted. The effect is to increase the total permitted weights by the number of axles times 500.

- **Prince Edward Island:** A tolerance of 1,000 pounds (in practice rounded to 500 kg) is allowed on each axle. The effect is to increase allowable GVWs by the number of axles times 500 kg over the maximum registered weight, except that in no case can the maximum GVW exceed 53,500 kg.

- **Nova Scotia:** A tolerance of 500 kg per axle is allowed, which has the effect of increasing allowable GVWs. That is, allowable GVWs are effectively those discussed in Section 3.6 plus the number of axles times 500 kg. Unlike Prince Edward Island and New Brunswick, the tolerances can be added to the 50,000 GVW limit for primary highways. This is an important point as it reduces the significance of some of the comparisons made elsewhere (eg, in Table 17, Nova Scotia is shown with the lowest GVW in the country). With the addition of these tolerances, the maximum actual, as compared to registered GVW in Nova Scotia is similar to other regions of the country.

- **New Brunswick:** Tolerances of 500 kg per axle permitted. The effect is to increase permitted weights above the maximum registered weights by 500 kg times the number of axles. For example, on a road with a GVW limit of 38,500 kg, the actual GVW limit is 38,500 plus tolerances; similarly on a road with a 50,000 kg limit, the actual GVW limit is 50,000 kg plus

tolerances. On the highways with a limit of 56,500 kg, however, tolerances cannot be used to push allowable weights above 56,500 kg.

- **Quebec:** No information on tolerances in Quebec has been obtained.

- **Ontario:** As of November 1, 1979, Ontario has had a policy of allowing 250 kg per axle, plus various amounts on GVW. In addition, there are certain higher loads that trigger off-loading requirements (ie, 2,000 kg over on a single axle requires off-loading).

- **Manitoba:** There are tolerances under the Act of 2% or 500 kg whichever is less (permanent weigh scales) and 5% or 500 kg whichever is less (portable weigh scales). That is, this much extra weight on each axle is allowed before a violation is recorded. Actual practices allow 500 kg over on a axle group (ie, a tandem) and 250 kg on a single axle.

- **Saskatchewan:** Officially, there are no tolerances; in practice, the Department of Highways lays down guidelines for its on-the-road enforcement staff.

- **Alberta:** Official tolerances permit 5% on GVW up to a maximum of 1,000 kg, and 500 kg per axle (provided that the tolerance on the GVW is not exceeded). In addition, there are some very high tolerances permitted for trucks carrying certain field crops at certain times of the year (eg, up to 2,000 kg on the GVW or 1,000 kg on an individual axle).

- **British Columbia:** There are no official tolerances in British Columbia. In their place, the province permits a truck that is over-loaded on some of its axles to either redistribute its load or to purchase overload permits of up to 500 kg on a single axle, 1,000 kg on a tandem axle, and 1,500 kg on the GVW.

- **Yukon:** No information has been obtained.

- **Northwest Territories:** There are no official tolerances; in practice, up to 1,000 kg per axle or the GVW but not both, is allowed.

4.4 THE ROLE OF LOCAL GOVERNMENTS

- **Newfoundland, Prince Edward Island, Quebec, the Yukon, and the Northwest Territories:** In these jurisdictions, local governments either have no authority to regulate weight and dimension regulations, or no information on this authority has been obtained (if it exists).

- **Nova Scotia:** Local authorities can impose temporary weight restrictions for a period of no more than 90 days per calendar year.

- **New Brunswick:** A local government may impose its own weight and dimension regulations on any of its own roads as long as the road is not

designated as a provincial highway. It is not known whether any local government has done this.

- **Ontario**: Local governments have a great deal of control over weight and dimension regulations if they chose to exercise it. That is, by designating a road as class "B", a local government can effectively ban the largest trucks from its roads. For example, assuming a 5,000 kg steering axle and tandem spreads of 1.8 m, the standard 3-S2 would be limited to 27,000 kg on a Class "B" road as compared to 43,200 kg on a Class "A". No information on the number of Class "B" roads has been obtained; however, it is believed that they are no longer very common.

- **Manitoba**: Winnipeg is the only local government in Manitoba with any regulation of weights and dimensions. In general, Winnipeg's regulations conform to the provincial ones except that some routes are restricted to a maximum GVW of 36,500 kg.

- **Saskatchewan**: Once a provincial highway enters the incorporated limits of an urban community over 1,000 population it becomes a "public highway" (ie, and not a "provincial highway"). As such, weight and dimension regulations under the Highways Act no longer apply. Local governments can, by by-law, set their own weight and dimension regulations but these must be approved by a provincial agency (the Highways Traffic Board). As a matter of practice, highway routes through urban areas are under weight and dimension regulations consistent with the provincial highways.

- **Alberta**: Local governments can regulate their own weights (not dimensions); they usually follow the province (including the + 10% in winter).

- **British Columbia**: Vancouver and Victoria have their own by-laws.

4.5 SPECIAL PERMITTING

The regulations of each province allow vehicles to operate at greater dimensions or greater loads than those discussed in Part 3. It is difficult to document the "rules" used in the granting of these special permits (they tend to not be written); it is difficult to acquire any factual material on the number of such permits issued; and it is extremely difficult to compare the "special-permitting situation" in one province with that in another (eg, special permits can be very different in a time sense or in an over-dimensional or over-weight sense; and in some cases what is a special permit situation in one province may only be an "excepted" situation or even a "standard" situation in another province).

5. Analysis & Comparison

5.1 INTRODUCTION

In this Part, various aspects of earlier sections are brought together for the purpose of understanding interjurisdictional differences. In particular, and unlike earlier sections, the analysis here focuses on comparisons where more than one element of weight and dimension regulations are involved.

5.2 TIRE-LOAD VERSUS AXLE-LOAD LIMITS

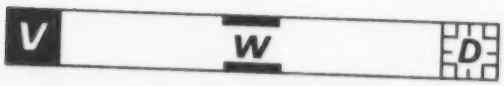
In Tables 29 and 30, a comparison is made of some aspects of the tire-load regulations and axle-load regulations.

- 10 inch tires: In Table 29, it can be seen that with 10 inch tires, the constraining factor on all single and tandem axles **except** steering (or single-tire axles) is the axle-load regulations in **all** provinces and/or territories. Although triple axles have not been shown, the same point is also true for them.

- Winter loads: although this is not shown in the following two tables, the increase in allowable axle weights in some provinces in the winter creates a situation where 10 inch tires can still be used (ie, without exceeding the tire-load limits) in all but two instances. These are in respect of single axles (**not** tandem) in both Manitoba and Alberta where winter axle loads of 10,010 kg exceed a load of 9,144 kg permitted on 10 inch tires. This same problem does not exist for tandem axles (winter loads of 17,600 kg in Manitoba and 18,040 kg in Alberta versus a permitted maximum of 18,288 kg on 10 inch tires).

- Saskatchewan: For all axles with dual tires, 10 inch tires are adequate in Saskatchewan in the winter as **both** axle and tire-loads are increased.

- Single-Front-Steering Axles: As shown in Table 30, the permitted front-steering-axle loads, when combined with tire-load requirements, result in a complex array of regulations across Canada. These heavy front-axles are only relevant for some of the more specialized type of trucks (dump, cement, etc., usually associated with dense commodities and/or construction-type activity).



axle: tires	Maximum Tire Load 10 inch tires, summer			Maximum Axle Load primary roads, summer (1)		
	single 2	single 4	tandem 8	single steering 2	single 4	tandem 8
Nfld	5,080	10,160	20,320	9,000	9,000	18,000
PEI (2)	5,897	10,872	21,744	9,000	9,000	18,000
NS	(3)	(3)	(3)	9,000	9,000	18,000
NB	5,436	10,872	21,744	9,000	9,000	18,000
Que	(3)	(3)	(3)	8,500	10,000	20,000
Ont	5,588	11,176	22,352	9,000	10,000	19,100
Man	4,572	9,144	18,288	8,190 7,300 5,500	9,100	16,000
Sask	4,572	9,144	18,288	5,500	9,100	16,000
Alta (4)	4,572	9,144	18,288	7,300	9,100	16,800
BC	5,588	11,176	22,352	9,100	9,100	17,000
Yukon	5,588	11,176	22,352	9,000	10,000	19,100
NWT	4,064	8,128	16,256	8,064	8,128	16,256

NOTES:

(1) assuming appropriate spreads and spacing

(2) if tires are 10.00 x 22, 16 ply, load range "H"

(3) load subject to manufacturer's rating

(4) tire load limits are as shown or tire-rating, whichever is less

Table 29 Tire-Load versus Axle-Load Limits

	maximum axle load (kg)	maximum tire load (kg/mm)	total mm of tire required	inches divided by two	tire size rounded
Nfld	9,000	10	900.00	17.72	18"
PEI	9.000 (1)	(9.92)	--	--	18"
NS	9,000	(2)	--	--	--
NB	9,000	10.7	841.12	16.56	17"
Que	8,500	(2)	--	--	--
Ont	9,000	11	818.18	16.10	17"
Man	8,190	9	910.00	17.91	18"
	7,300	9	811.11	15.97	16"
	5,500	9	611.11	12.02	12"
Sask	5,500	9	611.11	12.02	12"
Alta	7,300 (3)	(8.98)	--	--	16"
BC	9,100	11	827.27	16.28	17"
Yukon	9,000	11	818.18	16.10	17"
NWT	6,500 (4)	(9.18)	--	13.94	14"

NOTES:

(1) 20,000 lbs with tires: 18.00 x 22.5, 18 ply, load range "J".

(2) Load subject to manufacturer's rating

(3) The regulations permit 7,300 kg on axles with single tires if tires are 1600 x 20, with a rated capacity of 3,650 kg (each)

(4) 3,250 kg on a 35.4 cm tire, for front-steering tires only

Table 30 Front-Steering-Axle Loads versus Tire Size

5.3 COMPARISON OF AXLE LOADS

In this Section, a number of comparisons of axle loads is given under a variety of conditions (spreads, spacing), seasons, road classes, and tire sizes. While all of the information discussed in this Section has been given previously, the comparisons provided here summarize the differences between jurisdictions. There are a number of general and jurisdictional-specific notes that need to be made:

- Terminology: In Tables 31 to 33 the terms "primary" and "secondary" roads and "summer", "winter", and "spring" season are used in a general sense; they do not correspond to the particular regulations of any province. What is shown as a secondary highway on the table for axle-load regulations does not necessarily encompass the same roads as those for spring-load reductions (eg, Ontario's spring-reductions to 5,000 kg per axle in Table 31 may apply to different roads than those shown with a 8,200 kg single- axle load limit -- even though the Table shows both of these roads as "secondary").

- Tire Size: (see Section 5.2) 10 inch tires have been used in all cases except in Table 31 where 11 inch tires are necessary (as indicated by "T").

- Axle Spreads: In Table 32, it is possible to show tandem axle loads with a uniform spread of 1.8 metres (in actual fact, the spread requirements in Prince Edward Island are 1.83 m). This is not possible in Table 33 where triple axles are shown (see the discussion in Section 3.5.5).

- Prince Edward Island: Figures shown in Tables 31 to 33 have been rounded to the metric units used in practice.

- Quebec: The higher loads shown in the last column of all three tables are permitted on the James Bay roads (for the tandem axles shown in Table 32, the load would be allowed up to 24,000 kg if the spread had been set at 2.4 m) ; the "spring" loads are actually for periods of "rain or thaw"; the higher tandem axle loads shown in the second row in Table 32 are permitted for the hauling of unsawn forest products or for dump (etc.) trucks (ie, the spread conditions do not apply in these situations); and, also in Table 32, the "spring" reductions do not apply to dump (etc.) trucks but they do apply for the hauling of unsawn timber.

- Ontario: The higher axle loads shown in the last column of all three Tables are for trucks hauling raw forest products during the winter. The triple-axle loads shown in Table 33 for secondary roads (24,600 kg) would be 16,500 kg if the outer spread was less than 4.8 metres.

- Manitoba: The 8,200 kg axle load shown in the last column of Tables 32 and 33 is for Class C roads (see Section 4.2).

- British Columbia: The 9,600 kg axle-load limit shown in Table 31 is permitted for logging trucks.

	primary roads			secondary roads			other
	summer	winter	spring	summer	winter	spring	
Nfld	9,000	9,000	9,000	9,000	9,000	9,000	
PEI	9,000	9,000	9,000	9,000	9,000	4,500	
NS	9,000	9,000	9,000	9,000	9,000	6,500	
NB	9,000	9,000	9,000	9,000	9,000	%%	
Que	10,000	10,000	8,000	10,000	10,000	8,000	12,000
Ont	10,000	10,000	10,000	8,200	8,200	5,000	11,000
Man	9,100	10,010 T	9,100	8,200	8,200	8,200	
Sask	9,100	10,010	9,100	8,200	10,010	8,200	
Alta	9,100	10,010 T	9,100	9,100	10,010 T	%%	
BC	9,100	9,100	9,100	9,100	9,100	9,100	9,600
Yukon	10,000	10,000	10,000	10,000	10,000	10,000	
NWT	8,128	8,941	%%	8,128	8,941	%%	

NOTES:

all axles equipped with dual 10 inch tires, except where indicated with "T" (see text); appropriate axle spacing assumed

%% percent reductions used in the spring

Table 31 Comparison of Single-Axle Loads

	primary roads			secondary roads			other
Season	summer	winter	spring	summer	winter	spring	
Nfld d	17,000	17,000	17,000	17,000	17,000	17,000	
t	18,000	18,000	18,000	18,000	18,000	18,000	
PEI d	17,000	17,000	17,000	17,000	17,000	5,500	
t	18,000	18,000	18,000	17,000	17,000	5,500	
NS d	17,000	17,000	17,000	17,000	17,000	12,000	
t	18,000	18,000	18,000	17,000	17,000	12,000	
NB d	17,000	17,000	17,000	17,000	17,000	%%	
t	18,000	18,000	18,000	18,000	18,000	%%	
Que	19,000	19,000	15,500	19,000	19,000	15,500	22,800
(1)	20,000	20,000	20,000	20,000	20,000	20,000	
Ont	19,100	19,100	19,100	11,000	11,000	10,000	21,010
Man	16,000	17,600	16,000	14,500	14,500	14,500	8,200
Sask	16,000	17,600	16,000	14,500	17,600	14,500	
Alta	16,400	18,040	16,400	16,400	18,040	%%	
BC	17,000	17,000	17,000	17,000	17,000	17,000	
Yukon	19,100	19,100	19,100	19,100	19,100	19,100	
NWT	16,256	17,882	%%	16,256	17,882	%%	

NOTES:

- dual 10 inch tires and 1.8 m spreads on all axles.
- appropriate axle spacing assumed.
- "d" indicates drive axles; "t" indicates tandems on (semi)trailers

%% percent reductions used in the spring

(1) Some vehicles or commodities.

Table 32 Comparison of Tandem-Axle Loads

	primary roads			secondary roads			other
	summer	winter	spring	summer	winter	spring	
Nfld	27,000	27,000	27,000	27,000	27,000	27,000	
PEI	27,000	27,000	27,000	27,000	27,000	5,500	
NS	27,000	27,000	27,000	17,000	17,000	12,000	
NB	27,000	27,000	27,000	27,000	27,000	%%	
Que	30,000	30,000	24,500	30,000	30,000	24,500	36,000
Ont	28,600	28,600	28,600	24,600	24,600	15,000	31,460
Man (1)	16,000	17,600	16,000	14,500	14,500	14,500	8,200
Sask (1)	16,000	17,600	16,000	14,500	17,600	14,500	
Alta (1)	16,800	18,040	%%	16,800	18,480	%%	
BC (1)	17,000	17,000	17,000	17,000	17,000	17,000	
Yukon	28,600	28,600	28,600	28,600	28,600	28,600	
NWT (1)	16,256	17,882	%%	16,256	17,882	%%	

NOTES:

- dual 10 inch tires and 4.8 m spreads assumed, except: PEI (4.88); NS (4.85); Man (3.0); Sask (2.0); Alta (2.4); BC (1.85);
- appropriate axle spacing assumed

%% percent reductions used in the spring

(1) treated as tandem axles

Table 33 Comparison of Triple-Axle Loads

5.4 AXLE SPACING

Detailed information on the axle spacing requirements is given in Part 3. In this Section, the effect of these different spacing requirements is shown.

- Atlantic Canada: The information shown has to be interpreted differently than in other provinces. The loads shown at various spacings indicate the "minimum spacing requirements" contained in their GVW schedules (see Table 18 in Section 3.6). For example, in Table 34, 18,000 kg is shown for Newfoundland at an outer spacing of 2.4 metres and at 3.7 metres (which should actually be 3.65 metres if a finer scale had been used). The 2.4- metre spacing is the distance at which two single axles must be spaced in some truck or combination types for them to carry a load of 9,000 plus 9,000 kg (for example, the pup trailer in a 2-2); the 3.65-metre spacing is the distance two single axles must be spaced in other types of trucks or combinations (for example, a pup trailer in a 3-3 combination). For provinces in regions outside of Atlantic Canada, the load shown at a particular spacing is applicable reading down the Table until the next highest load shown.

- Prince Edward Island: The loads and spacings used are the Imperial units used in the regulations converted precisely to metric units. In practice, these may be rounded to values similar to those found in the other Atlantic provinces.

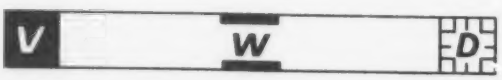
- Quebec, Ontario, and the Yukon: The spacing requirements in these jurisdictions are more complex than can be fully shown in the following tables (see Section 3.6). That is, as spacing of more than or greater than just the axles shown on these tables are taken into consideration, some load adjustments to total GVW might have to occur to combinations with the axles and spacings shown in the following tables. For example, while the following tables show the loads allowed on axles groups in Ontario, a consideration of the inter-vehicle-unit-distance, the base length, and the front-axle load would also have to be known before it was possible to determine the total load permitted and, hence, the actual load on any group of axles.

- Ontario and the Yukon: The information shown in Tables 34 to 39 only applies to axles entirely within a vehicle (eg, a semitrailer, a trailer, or a power unit).

- Table 34: The load allowed on two single axles (excluding single- front-steering axles) is shown; for ease of reference, the single- axle load limit is shown in the first line. In the case of Ontario and the Yukon, the loads shown are as per the permitted loads for two-axle groups; hence, in these two cases, the analysis is within a single vehicle. (The information shown in Table 34 can be most easily understood in terms of a two-axle pup trailer -- although in some of the provinces, the information shown is not limited to just this particular situation).

outer spacing (metres)	Permitted Load (in 1,000 kg)											
	Nfld	PEI	NS	NB	Que	Ont	Man	Sask	Alta	BC	YU	NWT
single =	9.0	9.0	9.0	9.0	10.0	10.0	9.1	9.1	9.1	9.1	10.0	8.1
0 - 0.99	-NP-	-NP-	-NP-	-NP-	10.0	10.0	9.1	9.1	9.1	9.1	10.0	16.2
1.0					20.0	15.0	16.0	16.0	.	16.5	15.0	.
1.1					.	.	.	.	.	.	.	.
1.2					.	16.3	.	.	.	.	16.3	.
1.3					.	16.7	.	.	.	.	16.7	.
1.4					.	17.0	.	.	.	.	17.0	.
1.5					.	17.4	.	.	.	17.0	17.4	.
1.6					.	17.8	.	.	.	.	17.8	.
1.7					.	18.2	.	.	.	.	18.2	.
1.8					.	18.6	.	.	16.0	.	18.6	.
1.9					.	19.1	.	.	.	18.0	19.1	.
2.0					.	20.0	.	.	.	.	20.0	.
2.1					.	.	.	.	.	.	.	.
2.2					.	.	.	.	.	.	.	.
2.3						.	.	.	.	18.2	.	.
2.4	18.0		18.0	18.0	.	.	.	.	16.8	.	.	.
2.5		18.1		.	.	.	.	.	.	.	.	.
2.6					.	.	.	.	.	.	.	.
2.7					.	.	.	.	.	.	.	.
2.8					.	.	.	.	.	.	.	.
2.9					.	.	16.2	.	.	.	.	.
3.0				18.0	.	.	16.6	.	17.2	.	.	.
3.1					.	.	16.9	.	.	.	.	.
3.2					.	.	17.2	16.8	.	.	.	.
3.3					.	.	17.5	.	.	.	.	.
3.4					.	.	17.9	.	.	.	.	.
3.5					.	.	18.2	18.2	18.2	.	.	.
3.6					.	.	.	.	.	.	.	.
3.7	18.0		18.0		.	.	.	.	.	.	.	.
3.8					.	.	.	.	.	.	.	.
3.9					.	.	.	.	.	.	.	.
4.0					.	.	.	.	.	.	.	.
4.1					.	.	.	.	.	.	.	.
4.2					.	.	.	.	.	.	.	.
4.3				18.0	.	.	.	.	.	.	.	.
4.4					.	.	.	.	.	.	.	.

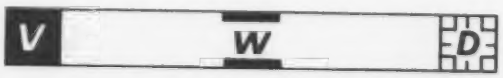
Table 34 Axle Spacing: Single to Single



- Table 35: The load allowed on a tandem axle with a spread of 1.0 metres plus a single axle is shown. In Atlantic Canada, the shortest tandem spread allowed is 1.2 metres, so "NP" or not permitted applies to the whole table. In Ontario and the Yukon, a tandem must have a spread of more than 1.0 metres to be recognized as a tandem; hence, the load shown at an outer spacing of 3.6 metres in Table 35 for these two jurisdictions is for a two-axle group plus a single (the loads shown up to that point are for a three-axle group).

outer spacing (metres)	Permitted Load (in 1,000 kg)											
	Nfld	PEI	NS	NB	Que	Ont	Man	Sask	Alta	BC	YU	NWT
2.0	-NP-	-NP-	-NP-	-NP-	17.5	19.0	16.9	16.0	-NP-	18.0	19.0	16.2
2.1					.	.	17.2	.		.	.	.
2.2					.	.	17.5	.		.	.	.
2.3					.	.	17.8	.		19.0	.	.
2.4					27.5	20.4	18.2	.		.	20.4	.
2.5					.	.	18.5	.		.	.	.
2.6					.	21.0	18.8	.		20.0	21.0	.
2.7					.	.	19.2	16.7		.	.	.
2.8					.	21.4	19.5	.		.	21.4	.
2.9					.	21.7	19.8	.		.	21.7	.
3.0					.	22.0	20.2	18.1		21.0	22.0	.
3.1					.	22.4	20.5	.		.	22.4	.
3.2					.	22.7	20.8	.		.	22.7	.
3.3					.	23.0	21.1	19.5	19.5	.	23.0	.
3.4					.	23.4	21.5	.	.	22.0	23.4	.
3.5					.	23.7	21.8	.	.	.	23.7	.
3.6					.	25.0	22.1	20.9	20.9	.	25.0	.
3.7					.	.	22.5	.	.	.	.	.
3.8					.	.	22.8	.	.	23.0	.	.
3.9					.	.	23.1	22.3	22.3	.	.	.
4.0					.	.	23.5	.	.	.	.	.
4.1					.	.	23.8	.	.	.	.	.
4.2					.	.	24.1	23.7	23.7	24.0	.	.
4.3					.	.	24.4	.	.	.	.	.
4.4					.	.	24.8	.	.	.	.	.
4.5					.	.	25.1	25.1	25.1	.	.	.
4.6					.	.	.	.	.	25.0	.	.
4.7					.	.	.	.	.	.	.	.
4.8					.	.	.	.	.	.	.	.
4.9					.	.	.	.	.	.	.	.
5.0					.	.	.	.	.	25.6	.	.
5.1					.	.	.	.	.	.	.	.
5.2					.	.	.	.	.	.	.	.
5.3					.	.	.	.	.	.	.	24.3
5.4					.	.	.	.	.	.	.	.

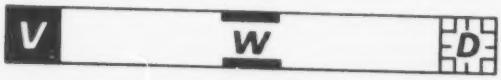
Table 35 Axle Spacing: Single to Tandem (1.0)



outer spacing (metres)	Permitted Load (in 1,000 kg)											
	Nfld	PEI	NS	NB	Que	Ont	Man	Sask	Alta	BC	YU	NWT
2.5	-NP-	-NP-	-NP-	-NP-	28.0	20.4	16.9	16.0	-NP-	19.0	20.4	16.2
2.6					.	21.0	17.2	.		20.0	21.0	.
2.7					.	.	17.5	.		.	.	.
2.8					.	21.4	17.8	.		.	21.4	.
2.9					.	21.7	18.2	.		.	21.7	.
3.0					.	22.0	18.5	.		21.0	22.0	.
3.1					.	22.4	18.8	.		.	22.4	.
3.2					.	22.7	19.2	16.7		.	22.7	.
3.3					.	23.0	19.5	.		.	23.0	.
3.4					.	23.4	19.8	.		22.0	23.4	.
3.5					.	23.7	20.2	18.1		.	23.7	.
3.6					.	24.0	20.5	.		.	24.0	.
3.7					.	24.4	20.8	.		.	24.4	.
3.8					.	24.7	21.1	19.5	19.5	23.0	24.7	.
3.9	26.0		26.0	26.0	.	25.0	21.5	.	.	.	25.0	.
4.0					.	25.4	21.8	.	.	.	25.4	.
4.1					.	27.9	22.1	20.9	20.9	.	27.9	.
4.2					.	.	22.5	.	.	24.0	.	.
4.3		26.1			.	.	22.8	.	.	.	.	.
4.4					.	.	23.1	22.3	22.3	.	.	.
4.5			26.0	26.0	.	.	23.5	.	.	.	.	.
4.6	26.0	26.1			.	.	23.8	.	.	25.0	.	.
4.7					.	.	24.1	23.7	23.7	.	.	.
4.8					.	.	24.4	.	.	.	.	.
4.9					.	.	24.8	.	.	.	.	.
5.0					.	.	25.1	25.1	25.1	26.0	.	.
5.1					.	.	.	.	.	.	.	.
5.2	26.0		26.0	26.0	.	.	.	.	.	.	.	.
5.3					.	.	.	.	.	.	.	.
5.4					.	.	.	.	.	.	.	.
5.5					.	.	.	.	.	.	.	.
5.6					.	.	.	.	.	.	.	.
5.7					.	.	.	.	.	.	.	.
5.8	26.0		26.0	26.0	.	.	.	.	.	.	.	24.3
5.9					.	.	.	.	.	.	.	.

Table 36 Axle Spacing: Single to Tandem (1.5)

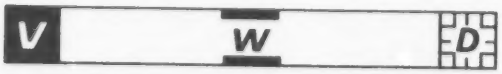
- Table 37: In both Tables 37 and 38, two possible loads are shown for Newfoundland, Nova Scotia, and New Brunswick. The two possibilities (17 + 9, versus 18 + 9) depend on whether or not the tandem axle is on a power unit or a towed unit (see Part 3).



outer spacing (metres)	Permitted Load (in 1,000 kg)											
	Nfld	PEI	NS	NB	Que	Ont	Man	Sask	Alta	BC	YU	NWT
2.8	-NP-	-NP-	-NP-	-NP-	29.0	21.4	16.9	16.0	-NP-	20.0	21.4	16.2
2.9					.	21.7	17.2	.		.	21.7	.
3.0					.	22.0	17.5	.		21.0	22.0	.
3.1					.	22.4	17.8	.		.	22.4	.
3.2					.	22.7	18.2	.		.	22.7	.
3.3					.	23.0	18.5	.		.	23.0	.
3.4					.	23.4	18.8	.		22.0	23.4	.
3.5					.	23.7	19.2	16.7		.	23.7	.
3.6					.	24.0	19.5	.		.	24.0	.
3.7					.	24.4	19.8	.		.	24.4	.
3.8					.	24.7	20.2	18.1		23.0	24.7	.
3.9					.	25.0	20.5	.		.	25.0	.
4.0					.	25.4	20.8	.		.	25.4	.
4.1					.	25.7	21.1	19.5	19.9	.	25.7	.
4.2	26.0		26.0	26.0	.	26.0	21.5	.	.	24.0	26.0	.
4.3					.	26.4	21.8	.	.	.	26.4	.
4.4					.	29.1	22.1	20.9	21.3	.	29.1	.
4.5					.	.	22.5	.	.	.	.	.
4.6		27.2			.	.	22.8	.	.	25.0	.	.
4.7					.	.	23.1	22.3	22.7	.	.	.
4.8			26.0	26.0	.	.	23.5	.	.	.	.	.
4.9	26.0	26.1			.	.	23.8	.	.	.	.	.
5.0					.	.	24.1	23.7	24.1	26.0	.	.
5.1					.	.	24.4	.	.	.	.	.
5.2					.	.	24.8	.	.	.	.	.
5.3					.	.	25.1	25.1	25.5	26.1	.	.
5.4					.	.	.	.	.	.	.	.
5.5 -	26.0		26.0	26.0	.	.	.	.	.	.	.	.
-	27.0		27.0	27.0	.	.	.	.	.	.	.	.
5.6					.	.	.	.	.	.	.	.
5.7					.	.	.	.	.	.	.	.
5.8					.	.	.	.	.	.	.	.
5.9					.	.	.	.	.	.	.	.
6.0					.	.	.	.	.	.	.	.
6.1	27.0		27.0	27.0	.	.	.	.	.	.	.	24.3
6.2					.	.	.	.	.	.	.	.

Table 37 Axle Spacing: Single to Tandem (1.8)

- Table 38: No loads are shown for Manitoba, Saskatchewan, and British Columbia: in all three cases, the tandem spread shown (2.4 m) is too wide to be permitted.



outer spacing (metres)	Permitted Load (in 1,000 kg)											
	Nfld	PEI	NS	NB	Que	Ont	Man	Sask	Alta	BC	YU	NWT
3.4	-NP-	-NP-	-NP-	-NP-	30.0	23.4	-NP-	-NP-	-NP-	-NP-	23.4	16.2
3.5					.	23.7					23.7	.
3.6					.	24.0					24.0	.
3.7					.	24.4					24.4	.
3.8					.	24.7					24.7	.
3.9					.	25.0					25.0	.
4.0					.	25.4					25.4	.
4.1					.	25.7					25.7	.
4.2					.	26.0					26.0	.
4.3					.	26.4					26.4	.
4.4					.	26.7					26.7	.
4.5					.	27.0					27.0	.
4.6					.	27.4					27.4	.
4.7					.	27.7			20.3		27.7	.
4.8	26.0		26.0	26.0	.	28.0			.		28.0	.
4.9					.	28.3			.		28.3	.
5.0					.	29.1			21.7		29.1	.
5.1					.	.			.		.	.
5.2		27.2			.	.			.		.	.
5.3					.	.			23.1		.	.
5.4			26.0	26.0	.	.			.		.	.
5.5	26.0	26.1			.	.			.		.	.
5.6					.	.			24.5		.	.
5.7					.	.			.		.	.
5.8					.	.			.		.	.
5.9					.	.			25.9		.	.
6.0					.	.			.		.	.
6.1 -	26.0		26.0	26.0	.	.			.		.	.
-	27.0		27.0	27.0	.	.			.		.	.
6.2					.	.			.		.	.
6.3					.	.			.		.	.
6.4					.	.			.		.	.
6.5					.	.			.		.	.
6.6					.	.			.		.	.
6.7	27.0		27.0	27.0	.	.			.		.	24.3
6.8					.	.			.		.	.

Table 38 Axle Spacing: Single to Tandem (2.4)

outer spacing (metres)	Permitted Load (in 1,000 kg)											
	Nfld	PEI	NS	NB	Que	Ont	Man	Sask	Alta	BC	YU	NWT
4.0	-NP-	-NP-	-NP-	-NP-	36.0	25.3	18.8	16.0	19.5	23.0	25.3	16.2
4.1					.	25.7	19.1	.	20.9	.	25.7	.
4.2					.	26.0	19.5	.	.	24.0	26.0	.
4.3					.	26.4	19.8	.	.	.	26.4	.
4.4					.	26.7	20.1	.	22.3	.	26.7	.
4.5					.	27.1	20.5	.	.	.	27.1	.
4.6					.	27.5	20.8	.	.	25.0	27.5	.
4.7					.	27.8	21.1	16.6	23.7	.	27.8	.
4.8					.	28.2	21.4	.	.	.	28.2	.
4.9					.	28.5	21.8	.	.	.	28.5	.
5.0					.	28.9	22.1	18.0	25.1	26.0	28.9	.
5.1					.	29.3	22.4	.	.	.	29.3	.
5.2					.	29.6	22.8	.	.	.	29.6	.
5.3					.	30.0	23.1	19.4	.	27.0	30.0	.
5.4					.	30.3	23.4	.	.	.	30.3	.
5.5					.	30.7	23.8	.	.	.	30.7	.
5.6					.	35.8	24.1	20.8	.	.	35.8	.
5.7					.	.	24.4	.	.	28.0	.	.
5.8					.	.	24.7	.	.	.	.	.
5.9					.	.	25.1	22.2	.	.	.	.
6.0					.	.	25.4	.	.	.	.	.
6.1					.	.	25.7	.	.	29.0	.	.
6.2					.	.	26.1	23.6	.	.	.	.
6.3					.	.	26.4	.	.	.	.	.
6.4					.	.	26.7	.	.	.	.	.
6.5					.	.	27.1	25.0	.	30.0	.	.
6.6					.	.	27.4	.	.	.	.	.
6.7	34.0	34.0	34.0	34.0	.	.	27.7	.	.	.	.	.
6.8					.	.	28.1	26.4	26.4	.	.	.
6.9					.	.	28.4	.	.	31.0	.	.
7.0					.	.	28.7	.	.	.	.	.
7.1					.	.	29.0	27.8	27.8	.	.	.
7.2					.	.	29.4	.	.	32.0	.	.
7.3	34.0		34.0		.	.	29.7	.	.	.	.	32.4
7.4					.	.	30.0	29.2	29.2	.	.	.
7.5					.	.	30.4	.	.	.	.	.
7.6					.	.	30.7	.	.	33.0	.	.
7.7					.	.	31.0	30.6	30.6	.	.	.
7.8				34.0	.	.	31.3	.	.	.	.	.
7.9					.	.	31.7	.	.	.	.	.
8.0					.	.	32.0	32.0	32.0	.	.	.
8.1					.	.	.	.	.	.	.	.

Table 39 Axle Spacing: Tandem (1.5) to Tandem (1.5)

5.5 COMPARISON OF VEHICLE TYPES

The following illustrations combine aspects of all weight and dimension elements. As these have been described previously, this Section consists only of a series of tables showing various trucks and truck combinations.

The legend used in the tables is as follows:

o	•	a single-tire axle (ie, 2 tires in total)
0	•	a dual-tire axle (ie, 4 tires in total)
0--0	•	a tandem axle
0--0--0	•	a triple axle
1.2	•	axle spread, in metres
|- 10 -|	•	axle spacings, in metres
load	•	axle load, in tonnes

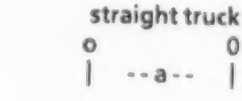
Truck specifications are as follows:

wb	•	tractor (truck) wheelbase
tw - fr	•	tire width - front, in inches
tw	•	tire width for non-front tires, in inches

Specifications
tw - fr 10"
tw 10"

straight truck

spacing



Parameters
- summer driving, primary roads

Object
- maximize axle loads

		Axle Loads		GVW	Min. Spacing
		#1	#2		(a)
Nfld		5.08	9.00	13.50	2.4
PEI	(a)	4.99	9.07	14.06	3.05
	(b)	5.90	9.07	14.97	3.51
NS	(a)	*	9.00	13.50	2.4
	(b)	*	9.00	18.00	2.4
NB		5.44	9.00	14.44	2.4
Que	(a)	*	10.00	15.50	**
	(b)	*	10.00	18.50	**
Ont		5.59	10.00	15.59	**
Man		4.57	9.10	13.67	2.8
Sask		4.57	9.10	13.67	3.5
Alta		4.55	9.10	13.65	3.0
BC		5.59	9.10	14.69	**
Yukon		5.59	10.00	15.59	**
NWT		4.06	8.13	12.19	**

* tire load governed by manufacturer's rating.
** no axle spacing requirements.

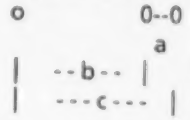
1) Steering axle: two 10" tires have been converted to 508 mm of tire width, with allowed loads of 8, 9, 10, 10.7, or 11 kg/mm.
2) Nfld • front axle load greater than 4.5 tne is permitted, but addition cannot be added to allowed GVW.
3) PEI • case (a) tires are 10 X 20, 14 ply, load range "G"
case (b) tires are 10 X 22, 16 ply, load range "H"
4) NS • case (a) assumes Atlantic standard 4.5 tne front axle; case (b) shows highest possible load (assuming tire rating).
5) Que • case (a) assumes 5.5 tne front axle; case (b) shows highest possible front axle (assuming tire rating).
6) Man • spacing is based on a requirement to reduce the allowed load of a 5.5 tne steering axle plus a 9.1 tne single axle by 330 kg for every 0.1 m less than 3.0 m (5,500 - 4,572 = 928 or 0.2 metres less than the standard 3.0 m spacing).
7) Alta • tire load regulations allow 4,572 kg on front axle; front-axle load regulations limit load to 4,550 kg.

Table 40 Two-Axle Truck

Specifications
tw - fr 10"
tw 10"

straight truck (or tractor)

spread spacings



Parameters
- summer driving, primary roads

Object
- maximize axle loads
- minimize axle spacing

		Axle Loads		GVW	Spread	Min. Spacing	
		#1	#2-3		(a)	(b)	(c)
Nfld		5.08	17.00	21.50	1.5	2.4	3.9
PEI	(a)	4.99	17.01	22.00	1.52	3.05	4.57
	(b)	5.90	17.01	22.91	1.52	3.51	5.03
NS	(a)	*	17.00	21.50	1.5	2.4	3.9
	(b)	*	17.00	26.00	1.5	2.4	3.9
NB		5.44	17.00	22.44	1.5	2.4	3.9
Que	(a)	*	20.00	25.50	2.4	**	**
	(b)	*	20.00	28.50	2.4	**	**
Ont		5.59	19.10	24.69	1.8	2.6	4.4
Man		4.57	16.00	20.57	1.0-2.0	2.8	4.0
Sask		4.52	16.00	20.57	1.0-2.0	3.5	4.7
Alta		4.55	16.80	21.35	2.4	3.0	5.4
BC		5.59	17.00	22.59	1.5	1.9	3.4
Yukon		5.59	19.10	24.68	1.8	2.6	4.4
NWT		4.06	16.26	20.32	**	**	**

* tire load governed by manufacturer's rating.
** no axle spread/spacing requirements.

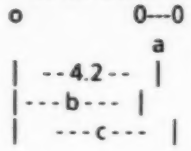
1) Steering axle: two 10" tires have been converted to 508 mm of tire width, with allowed loads of 8, 9, 10, 10.7, or 11 kg/mm.
2) Nfld • front axle load greater than 4.5 tne is permitted, but addition cannot be added to allowed GVW.
3) PEI • case (a) and (b) as in Table 40.
4) NS • case (a) and (b) as in Table 40.
5) Que • case (a) and (b) as in Table 40; tandem drive axles with 2.4 m spread are unrealistic; some straight trucks allowed 20.0 tne on tandems with no spread requirements.
6) Man • see Table 40 for notes on spacing (b); total spacing shown assumes a tandem spread of 1.2 m.
7) Sask • total spacing shown assumes a tandem spread of 1.2 m.
8) Alta • drive-tandem spreads of 2.4 m are unrealistic.

Table 41 Three-Axle Truck (or Tractor)

Specifications

wb 4.2
tw - fr 10"
tw 10"

straight truck (or tractor)



Parameters

- summer driving, primary roads
- maximum 4.5 tne front axle

Object

- maximize GVW

		Axle Loads		GVW	Spread	Spacing	
		#1	#2-3		(a)	(b)	(c)
Nfld		4.5	17.00	21.50	1.5	3.45	4.95
PEI		4.5	17.01	21.51	1.52	3.44	4.96
NS		4.5	17.00	21.50	1.5	3.45	4.95
NB		4.5	17.00	21.50	1.5	3.45	4.95
Que	(a)	4.5	20.00	24.50	2.4	3.00	5.40
	(b)	4.5	19.00	23.50	1.8	3.30	5.10
Ont		4.5	19.10	23.60	1.8	3.30	5.10
Man		4.5	16.00	20.50	1.0-2.0	3.60	4.80
Sask		4.5	16.00	20.50	1.0-2.0	3.60	4.80
Alta	(a)	4.5	16.80	21.30	2.4	3.00	5.40
	(b)	4.5	16.40	20.90	1.8	3.30	5.10
BC		4.5	17.00	21.50	1.5	3.45	4.95
Yukon		4.5	19.10	23.60	1.8	3.30	5.10
NWT		4.06	16.26	20.32	**	3.60	4.80

** no axle spread/spacing requirements.

1) Tandem spreads of 1.2 m assumed in Man., Sask., and the N.W.T.

2) Que • drive-tandem spreads of 2.4 m may be rare; case (b) shows a more likely possibility (1.8 m drive tandems); some trucks allowed 20.0 tne on tandems with no spread requirement.

3) Alta • drive-tandem spreads of 2.4 m may be rare; case (b) shows a more likely possibility (1.8 m drive tandems).

4) With a 4.5 tne front axle, and a wheelbase of 4.2 metres, the sum of axle loads is the allowed GVW in all 12 jurisdictions. In other words, these specifications are sufficient to avoid the "load- penalty" provisions in all cases (or, in the case of Ont. and the Yukon, to avoid the load limit imposed by the tables in the regulations).

Table 42 Three-Axle Truck (or Tractor)
(fixed wheelbase)

Specifications

				tractor	semitrailer	
wb	4.2		o		0---0	0---0
tw - fr	11"	spreads			a	b
tw	11"	spacings	|	- 4.2 -	|	
					|- - 10.0 - - |	

Parameters

- summer driving, primary roads
- 10.0 m spacing from axle #3 - #4

Object

- maximize axle loads & GVW

		Axle Loads			GVW	Spreads	
		#1	#2-3	#4-5		(a)	(b)
Nfld		5.59	17.00	18.00	39.50	1.5	1.8
PEI	(a)	4.99	17.01	18.14	40.14	1.52	1.83
	(b)	5.90	17.01	18.14	41.05	1.52	1.83
NS	(a)	*	17.00	18.00	39.50	1.5	1.8
	(b)	*	17.00	18.00	44.00	1.5	1.8
NB		5.98	17.00	18.00	40.98	1.5	1.8
Que	(a)	*	20.00	20.00	45.50	2.4	2.4
	(b)	*	20.00	20.00	48.50	2.4	2.4
	(c)	5.50	19.00	20.00	44.50	1.8	2.4
Ont		6.15	19.10	19.10	44.35	1.8	1.8
Man		5.03	16.00	16.00	37.03	**	**
Sask		5.03	16.00	16.00	37.03	**	**
Alta	(a)	5.00	16.80	16.80	38.60	2.4	2.4
	(b)	5.00	16.40	16.80	38.20	1.8	2.4
BC		6.15	17.00	17.00	40.15	1.5	1.5
Yukon		6.15	19.10	19.10	44.35	1.8	1.8
NWT		4.47	16.26	16.26	36.98	**	**

* tire load governed by manufacturer's rating.

** no axle spread requirements.

1) For the steering axle, two 11" tires have been converted to 558.8 mm of tire width, with allowed loads of 8, 9, 10, 10.7, or 11 kg/mm.

2) Nfld • front axle load greater than 4.5 tne is permitted, but addition cannot be added to allowed GVW.

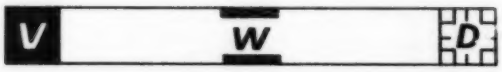
3) PEI • in case (a), tires are 11 X 22, 12 ply, load range "F;" in case (b), tires are 11 X 22, 14 ply, load range "G" (strictly, wheelbase in case (b) is 0.05 m too short).

4) NS • case (a) assumes 4.5 tne front axle; case (b) shows highest possible load (assuming tire rating).

5) Que • case (a) assumes 5.5 tne front axle; case (b) shows highest possible front axle (assuming tire rating); drive tandems with 2.4 m spread may be rare; case (c) shows more likely possibility (1.8 m drive tandems, 5.5 tne front axle).

6) Alta • drive-tandem spreads of 2.4 m may be rare; case (b) shows a more likely possibility (1.8 m drive tandems).

Table 43 Five-Axle Tractor-Semitrailer (fixed wheelbase, spacings)



Specifications

tw - fr 11"

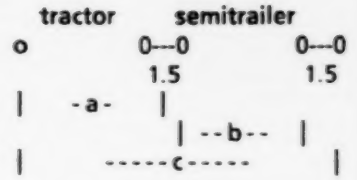
tw 11"

Parameters

- summer driving, primary roads
- fixed tandem spreads (1.5 m)

Object

- maximize axle loads & GVW



		Axle Loads			GVW	Minimum spacing required for GVW to equal sum-of-axle-load		
		#1	#2-3	#4-5		(a)	(b)	(c)
Nfld		5.59	17.00	17.00	39.50	3.05	3.65	9.70
PEI	(a)	4.99	17.01	17.01	39.01	3.05	3.66	9.75
	(b)	5.90	17.01	17.01	39.92	3.51	3.66	10.21
NS	(a)	*	17.00	17.00	38.50	3.0	3.65	9.65
	(b)	*	17.00	17.00	43.00	3.0	3.65	9.65
NB		5.98	17.00	17.00	39.98	3.0	3.65	9.65
Que	(a)	*	18.00	18.00	41.50	**	3.0	**
	(b)	*	18.00	18.00	44.50	**	3.0	**
Ont	(a)	6.15	17.90	17.90	41.95	4.2	3.3	10.5
	(b)	6.15	17.90	17.90	41.95	3.65	3.6	10.25
Man		5.03	16.00	16.00	37.03	2.9	5.0	10.9
Sask		5.03	16.00	16.00	37.03	3.5	5.0	11.5
Alta		5.00	16.00	16.00	37.00	3.0	5.0	11.0
BC		6.15	17.00	17.00	40.15	2.7	5.0	10.7
Yukon		6.15	17.90	17.90	41.95	4.2	3.3	10.5
NWT		4.47	16.26	16.26	36.98	**	4.27	**

* tire load governed by manufacturer's rating.

** no spacing requirements.

1) Steering axle loads as in Table 44.

2) Nfld • GVW limited to 39.5 tne.

3) PEI • tandems have spread of 1.52 m.

4) Ont • only two of several possibilities shown.

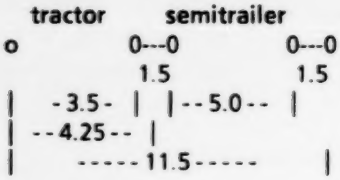
5) Man • Man - spacing (a) is based on a requirement to reduce the allowed load of a 5.5 tne steering axle plus a 16.0 tne tandem axle by 330 kg for every 0.1 m less than 3.0 m (5,500 - 5,029 = 471 or 0.1 metres less than the standard 3.0 m spacing).

6) Yukon • only one of several spacing possibilities shown.

Table 44 Five-Axle Tractor-Semitrailer (fixed spreads)

Specifications

wb	4.25		
tw - fr	11"	spreads	
tw	11"	spacings	



Parameters

- fixed spreads/spacings

Object

- maximize axle loads & GVW

		PRIMARY ROADS					SECONDARY ROADS			
		Axle Loads			GVW		Axle Loads			GVW
		#1	#2-3	#4-5			#1	#2-3	#4-5	
Nfld		5.59	17.00	17.00	39.50					
PEI	(a)	4.99	17.01	17.01	40.14	=	same			
	(b)	5.90	17.01	17.01	41.05	=	same			
NS	(a)	*	17.00	17.00	39.50	=	same			
	(b)	*	17.00	17.00	44.00	=	same			
NB		5.98	17.00	17.00	40.90	=	same			
Que	(a)	*	18.00	18.00	45.50					
	(b)	*	18.00	18.00	48.50					
Ont	(a)	6.15	17.90	17.90	44.35		6.15	11.00	11.00	28.15
- winter		6.76	19.69	19.69	46.14					
Man		5.03	16.00	16.00	37.03	=	5.03	14.50	14.50	34.03
- winter		5.03	17.60	17.60	40.23	=	??			
Sask		5.03	16.00	16.00	37.03	=	5.03	14.50	14.50	34.03
- winter		5.03	17.60	17.60	40.23	=	5.03	17.60	17.60	40.23
Alta		5.00	16.00	16.00	37.00					
- winter		5.00	17.60	17.60	40.20					
BC		6.15	17.00	17.00	40.15					
Yukon		6.15	17.90	17.90	44.35					
NWT		4.47	16.26	16.26	36.98					
- winter		4.92	17.88	17.88	40.68					

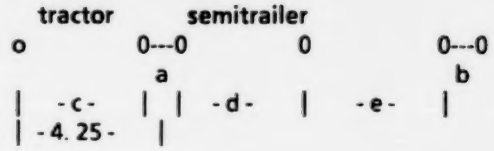
* tire load governed by manufacturer's rating.

1) No information shown for secondary roads where these do no exist or are unimportant.
2) Axle loads/GVW for primary/summer roads as in Table 44.
3) Ont • Secondary roads are relatively unimportant; winter loads apply only to transport of raw forest products.
4) Man • Unclear as to whether or not winter premiums apply to secondary roads (or all four classes of secondary roads).
5) Alta • Assumes winter load premiums do not apply to steering axle.
6) BC • Logging trucks are allowed 2.5 tne premiums on GVW in winter (and 1.5 tne during other parts of the year).

Table 45 Five-Axle Tractor-Semitrailer (primary/secondary roads, summer/winter)

Specifications

wb 4.25
tw - fr 12"
tw 11"



Parameters

- summer driving, primary roads

Object

- maximize axle loads & GVW

	Axle Loads				GVW	Spreads		Minimum Spacing		
	#1	#2-3	#4	#4-5		(a)	(b)	(c)	(d)	(e)
Nfld	6.10	17.00	9.00	18.00	48.50	1.5	1.8	3.5	4.25	3.0
PEI	5.90	17.01	9.07	18.14	50.12	1.52	1.83	3.51	4.27	3.05
NS (a)	*	17.00	9.00	18.00	48.50	1.5	1.8	3.5	4.25	3.05
(b)	*	17.00	9.00	18.00	50.00	1.5	1.8	3.5	4.25	3.05
NB	6.52	17.00	9.00	18.00	50.52	1.5	1.8	3.5	4.25	3.0
Que	8.50	20.00	9.00	20.00	57.50	2.4	2.4	2.45	4.5	2.4
Ont	6.50	19.10	10.0	18.40	54.00	1.8	1.7	3.35	5.65	2.5
BC	6.71	17.00	9.10	17.00	49.81	1.5	1.5	3.5	3.8	3.8

* tire load governed by manufacturer's rating.

1) For the steering axle, two 12" tires have been converted to 609.6 mm of tire width, with allowed loads of 8, 9, 10, 10.7. or 11 kg/mm.

2) In Man., Sask., Alta., and the NWT, a 3-S3 is not recognized (ie, would be treated as a 3-S2).

3) Spacing (c) is a residual in all cases (ie, it meets or exceeds the minimum requirements and is only a function of the tandem spread given a fixed wheelbase).

4) Nfld • front axle load greater than 4.5 tne is permitted, but addition cannot be added to allowed GVW.

5) PEI • assumes tires are 12 X 20, 14 ply, load range "G"; higher front axle loads are possible (with 12" tires), but GVW tables in regulations do not show required spacings.

6) NS • case (a) assumes 4.5 tne front axle; case (b) shows highest possible load (assuming tire rating).

7) Que • the only 3-S3 that could be registered at 57.5 tne would have to have a 8.5 tne front axle and a 2.4 m spread on the drive tandems; this is unlikely in practice.

8) Ont • one of several possibilities shown; to register at 54 tne, combination must have a front axle of at least 6.5 tne and a total axle spacing (#1-#6) of 15.0 m; minimum spacing required for (d) is 3.6 m however an additional 2.15 m has been added to give the required overall spacing of 15.0 m.

9) Yukon • not shown, but same as Ont.

Table 46 Six-Axle Tractor-Semitrailer (tri-axle)

Specifications

			tractor	semitrailer	trailer
wb	4.25		o	0---0 0 0	0
tw - fr	12"	spread		1.2	
tw	11"	spacings	| -4.25-	|| --a-- | --b--	| --c-- |
				| -----d-----	|

Parameters

- summer driving, primary roads
- fixed tandem spread (1.2 m)
- maximum front axle load (5.5 tne)

Object

- maximize axle loads & GVW

		Axle Loads					GVW	Minimum Spacing			
		#1	#2-3	#4	#5	#6		(a)	(b)	(c)	(d)
Nfld		- special permit									
PEI		- special permit									
NS		- special permit									
NB		- special permit									
Que		5.5	17.5	10.0	10.0	10.0	53.0	*	*	*	14.0
Ont	(a)	5.5	16.8	10.0	10.0	10.0	52.3	3.0	3.0	2.0	
	(b)						52.3	4.15	3.0	3.0	
Man		5.5	16.0	9.1	9.1	9.1	48.8	3.5	3.5	3.5	
Sask		5.5	16.0	9.1	9.1	9.1	48.8	3.5	3.5	3.5	
Alta		5.5	16.0	9.1	9.1	9.1	48.8	3.5	3.5	3.5	
BC		5.5	16.5	9.1	9.1	9.1	49.3	3.8	2.3	2.3	
Yukon		- special permit									
NWT		4.47	16.26	8.13	8.13	8.13	45.11	4.27	4.27	4.27	

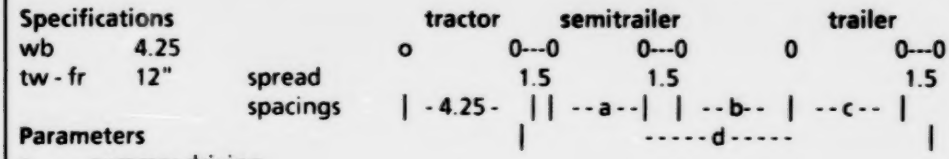
* no spacing requirements.

1) Ont • case (a) shows minimum axle spacings considering axle loads only; considering GVW, a total of 15.0 m is required between axle #1 and #6; case (b) shows one of several possibilities available to reach the overall spacing of 15.0 m.

2) NWT • spacings must be 14 ft (4.27 m); however, spacing (b) may not be enforced in practice.

Table 47 Six-Axle A-Train

Specifications



Parameters

- summer driving, primary roads
- fixed tandem spread (1.5 m)

Object

- maximize axle loads & GVW

		Axle Loads					GVW	Maximum Spacing			
		#1	#2-3	#4-5	#6	#7-8		(a)	(b)	(c)	(d)
Nfld		- special permit									
PEI		- special permit									
NS		- special permit									
NB		- special permit									
Que		*	18.0	18.0	10.0	18.0	57.5	*	*	*	14.0
Ont	(a)	6.71	17.9	17.9	10.0	17.9	63.1	3.6	3.6	2.5	
	(b)							4.0	4.0	3.25	
Man		5.49	16.0	16.0	9.1	16.0	56.5	5.0	3.5	3.5	
Sask		5.49	16.0	16.0	9.1	16.0	53.5	5.0	3.5	3.5	
Alta		5.45	16.0	16.0	9.1	16.0	62.5	5.0	3.5	3.5	
BC	(a)	6.0	17.0	17.0	9.1	17.0	63.5	5.0	3.8	3.8	
	(b)	6.0	17.0	14.4	9.1	17.0	63.5	4.2	2.7	3.8	
Yukon		- special permit									
NWT		4.47	16.26	16.26	8.13	16.26	54.00	4.27	4.27	4.27	

** no spacing requirements.

1) Que • front axle load indeterminate; note that sum of other axle loads far exceeds the GVW limit.
2) Ont • case (a) shows minimum axle spacings considering axle loads only; considering GVW, a total of 19.25 m is required between axle #1 and #8; case (b) shows one of several possibilities available to reach the overall spacing of 19.25 m.
3) Man • as the sum of the axle loads exceeds the allowable GVW limit, any combination of spacings shown could be reduced by approximately 1.8 m (6000/330 X 0.1)
4) Sask • as the sum of the axle loads exceeds the allowable GVW limit, any combination of spacings shown could be reduced by approximately 1.8 m (9000/1400 X 0.3).
5) Alta • 8-axle A-trains at 62.5 now operating under special permit.
6) BC • as the sum of axle loads exceeds GVW limit, spacings shown in case (a) could be reduced to, for example, those shown in case (b).
7) NWT • spacings must be 14 ft (4.27 m); however, spacing (b) may not be enforced in practice.

Table 48 Eight-Axle A-Train

Specifications			tractor	semitrailer	semitrailer
wb	4.25				
tw - fr	12"		o	0---0	0---0 0---0
tw	11"	spread		1.2	1.2 1.2
		spacings	|-4.25--|	|--a--|	|--b--|
			|----------c----------|		

Parameters

- summer driving, primary roads
- fixed tandem spread (1.5 m)
- maximum front axle load (5.5 tne)

Object

- maximize axle loads & GVW

	Axle Loads				GVW	Maximum Spacing		
	#1	#2-3	#4-5	#5-6		(a)	(b)	(c)
Nfld	5.5	16.0	16.0	16.0	52.5	4.25	4.25	
PEI	- special permit							
NS	5.5	16.0	16.0	16.0	50.0	4.25	4.25	
NB	5.5	16.0	16.0	16.0	53.5	4.8	4.8	
Que	5.5	17.5	17.5	17.5	57.5	*	*	15.5
Ont	5.5	16.8	16.8	16.8	55.9	4.75	4.5	
Man	5.5	16.0	16.0	16.0	53.5	5.0	5.0	
Sask	5.5	16.0	16.0	16.0	53.5	5.0	5.0	
Alta	5.5	16.0	16.0	16.0	53.5	5.0	5.0	
BC	5.5	16.5	16.5	16.5	55.0	5.2	5.2	
Yukon	- special permit							
NWT	4.47	16.26	16.26	16.26	53.24	4.27	4.27	

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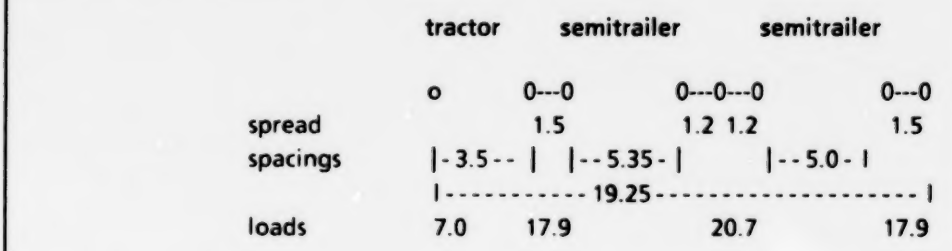
* no axle spacing requirement.

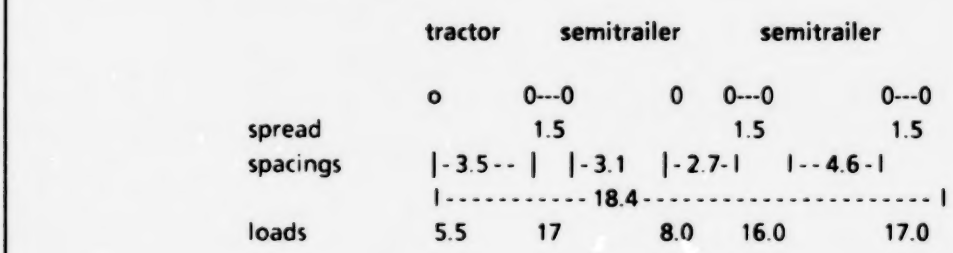
1) Ont - one possible axle spacing arrangement shown, given the shortest base length (16.5 m) possible.

Table 49 Seven-Axle B-Train

Ontario B-train (example)



British Columbia B-train (example)



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1) 8-axle B-trains only add to allowable GVW in Ontario and British Columbia.

2) The B-trains in each province are quite different: a) it is not practical to use triple axles in B.C. (because of the requirement that one of the axles self-steers and the load-spacing penalties); b) Ontario B-trains have to have higher front axle loads (all else equal); c) Ontario B-trains have to have a longer spacing from the first to last axle (all else equal); and d) there is far more room in Ontario to shift load around between various axles than in B.C.

Table 50 Eight-Axle B-Train

REFERENCES

1. American Trucking Association, 1985, *"Summary of Size and Weight Limits"*, Alexandria.

2. Canroad Transportation Research Corporation, 1986, *Vehicle Weights and Dimension Study: Technical Steering Committee Report*, Ottawa.

3. Ervin, R.D., 1984, *RTAC Study on Weights and Dimensions, Report on Task 1: A Survey of the Characteristics of Equipment in the Canadian Trucking Fleet*, Roads and Transportation Association of Canada, Ottawa.

4. *Ontario Commission on Truck Safety (Robert J. Uffen), 1983, Report*, Ontario Ministry of Transportation and Communications, Toronto.

5. Christison, J.T., Shields, B.P, 1982, *"Evaluation of the Relative Damaging Effects of Wide Base Tire Loads on Pavements"*, *RTAC Forum*, 4, 1, pp. 65 - 71.

6. Canroad Transportation Research Corporation, *op. cit.*

7. *Ibid.*